THE REVIEW

DEVOTED TO THE INTERESTS OF THE AMERICAN SOCIETY FOR METALS

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LITERATURE SURVEY IS NEW ASM SERVICE

Convention Papers Invited

ALL MEMBERS of the Society are cordially invited to submit technical papers to the Publication Committee for its consideration for presentation before the National Metal Congress to be held at the Statler Hotel in Cleveland the week of Oct. 16, 1944.

Three copies of the paper accompanied by three sets of drawings and illustrations must be sent to the National Office in Cleveland to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, not later than June 1, 1944. Headquarters should be notified immediately of your intention to submit a paper.

Helpful suggestions for the preparation of technical papers will be sent to all who indicate their intention to submit papers for the program.

National President Honored by Home Chapter

Reported by G. B. Berlien
Metallurgical Engineer
Lindberg Steel Treating Co.

Chicago Chapter—A capacity crowd paid homage to National President Marcus A. Grossmann, former Chicago Chapter chairman, and National Secretary Bill Eisenman on President's Night, Jan. 13.

Remarks by Bill Eisenman prefacing the president's talk were highlighted by his usual good humor and carried much food for thought and reason for pride in the work of the national organization.

Vice-Chairman J. Walter Scott, in the absence of Chairman Robbins, then reviewed the latest activities of President Grossmann and read many telegrams and letters from well-wishers. As a token of the Chapter's esteem, Dr. Grossmann was presented with a book honoring him for his achievements and signed by every member present at the meeting.

The final feature of the program was Dr. Grossmann's excellent talk on hardenability and effect of alloys, which is being delivered to many of the A.S.M. Chapters during the president's term of office.

Annotated Review of All Current Literature Starts in This Issue

The Review of Current Literature, a new service created by the American Society for Metals, is inaugurated with this issue of The Review, starting on page 2.

Designed to provide a complete, up-to-the-minute survey of the engineering, scientific and industrial journals of the world, this metal literature review consists of a classified list of articles that have appeared during the month just past with brief annotations indicating their content or scope.

It is being prepared in the library of Battelle Memorial Institute, Columbus, Ohio, and consists in a monthly survey of 120 of the leading American and foreign technical and trade periodicals plus important books issued during the preceding month.

Classified in 28 Subjects

This new service has been pioneered to fill the need for a complete, thorough and up-to-date reader service of use to both the theoretical and practical metal men of the A.S.M. Articles are classified under 28 subdivisions as follows:

Production of metals; properties of metals; properties of alloys; structure; powder metallurgy; corrosion; protection; electroplating; electrometallurgy; analysis; laboratory apparatus and instruments; physical and mechanical testing; temperature measurement and control; foundry practice; secondary metals; furnaces and fuels; refractories and furnace materials; heat treatment; working; machining; cleaning and finishing; welding, brazing and flame cutting; industrial uses and applications; design; miscellaneous; statistics; bibliography; book reviews.

Cross-Indexed by Materials

A supplementary "Materials Index" enables the reader to locate readily all of the articles on a specific metal or alloy.

For example, if a reader is interested in fabrication of aluminum, he might find it simpler to look up all the references to aluminum in the Materials Index rather than search through each of the pertinent subdivisions such as working, machining, welding, etc.

Many of the journals covered are readily available to A.S.M. members either through personal or company

(Continued on page 4, column 1)

Grossmann Receives Inscribed Volume

Chicago Chapter Vice-Chairman J. Walter Scott Presents National President Marcus A. Grossmann a Leather-Bound Volume, Suitably Inscribed and Signed by All of the Members Present, in Recognition of His Contributions to the Work of the Chapter. Left to right are Billy Williams, J. F. Calef, Harvey A. Anderson, National Secretary Bill Eisenman, F. G. Wheeler, President Grossmann, J. L. Burns, J. Walter Scott, A. M. Steever, R. S. Archer, E. A. Terwell, A. T. Clarage, W. D. McMillan, and K. H. Hobbie

Four Major Tests Detect Steel Defects

—Sergeson

Reported by E. K. Mull
Chief Metallurgist, Bendix Radio

Baltimore Chapter—A large attendance turned out to hear Robert Sergeson, chief metallurgist for the Park Works of Crucible Steel Co. of America, give a comprehensive talk on "Visual Inspection of Steel."

Four major tests are employed for detecting defects in steel at various stages of processing:

1. Macro-Etch, in which a cross-section is etched in 1/1 hydrochloric acid at 160 to 180° to disclose segregation, pipe, flake, pattern, and unsoundness.
2. Step-Down, in which a section is turned down to progressively smaller diameters with a fine finish to show hair line cracks.
3. Magnaflux, to show surface cracks and unsoundness. The quadrant method, taking a quarter of the section and Magnafluxing after machining, is the toughest of all tests to pass.
4. Carburize and fracture, in which inclusions are shown as gray streaks.

Numerous other tests, as bend, cup, etc., are required for steel in certain forms.

Specification Standards Raised

Standards have been raised tremendously in the past 20 years, with increased specification requirements resulting from developments in the automotive, airplane, and oil industries, also the railroad, textile, and military fields.

The principal ingot defects can be prevented by correct melting and teeming practice, proper cooling after pouring, mold design and condi-

(Continued on page 4, column 4)

Welded Ships Subject at AWS Joint Meeting

Reported by George G. Luther
Naval Research Laboratory

Washington Chapter—The annual joint meeting with the American Welding Society was held early in December with LaMotte Grover, welding engineer of Air Reduction Sales Co., as the speaker.

"Procedure Control and Details for Welded Ships and Other Large Structures" proved to be a particularly timely subject, since the failure of several welded cargo ships has highlighted the need for more careful study of stresses in large welded structures.

By way of introduction, the speaker described the status of welding in shipyards at the present time. Welding continued to gain favor in ship construction because it was found that there was a lack of riveters and that new welders could be trained more rapidly than new riveters. Technical difficulties and inconveniences were also a

(Continued on page 5, column 4)

Well-Balanced Menu for Officers' Night Includes Much Food for Thought

Reported by S. B. Knutson
Chief Metallurgist
Ordnance Management Division
St. Louis Ordnance Plant

St. Louis Chapter—The January meeting proved a fine introduction to a new calendar year of A.S.M. activities. As National Officers' Night it featured entertaining and instructive talks by the president and secretary.

The menu of the evening was particularly well balanced, both as to food for the body (roast beef) and food for thought. The wit and inimitable style of Secretary Eisenman were particularly appetizing

(Continued on page 5, column 3)

Orchids

To **Charles Ellison MacQuigg**, dean of engineering at Ohio State University, on the award of the James Turner Morehead Medal of the International Acetylene Association.

To **Carl Rosenberg**, chief plant metallurgist and assistant superintendent of Duquesne Smelting Co., on his prestige as a violinist and viola player, as noted in the Pittsburgh *Press* in the department devoted to "Who's Who in Pittsburgh Music Circles".

To the **National Stamping and Mfg. Co.** of Los Angeles and **K. T. Norris**, president, on the special commendation received from the Ammunition Branch of the Ordnance Department for its success in producing a satisfactory heat treated steel cartridge case for 3-in. anti-aircraft and anti-tank guns.

To **Carnegie-Illinois Steel Corp.** on the new production record of 22,743,000 ingot tons during 1943 set by the Chicago district plants.

McQuaid Cites Trends in Steel Selection and Use

Reported by H. Y. Hunsicker
Research Metallurgist
Aluminum Co. of America

Cleveland Chapter—Some 350 members and guests were present on Dec. 6 at the Cleveland Club to hear Harry W. McQuaid, assistant chief metallurgist of Republic Steel Corp. and consultant of the Iron and Steel Branch, War Production Board. Mr. McQuaid presented a broad discussion of the steel maker's and consumer's problems with particular emphasis on the contemporary trends in steel selection and application.

Pointing out that the steel melter must work by analysis, whereas the consumer's principal interest is in hardenability, the speaker brought forth the need for a more thorough understanding of the correlation between steel chemistry and quenching behavior.

A rational approach to the problem of ever-increasing residuals is provided by a series of steels containing substantial amounts of nickel, chromium and molybdenum which may be adjusted to meet a wide range of quenching rates.

The fundamental problem in steel treating, of course, is to dissolve the carbides and subsequently reprecipitate in the desired degree and dispersion and at the desired rate. In this respect it should be noted that the full hardening potentialities of plain carbon steels have not been generally utilized, and it was intimated that developments in quenching technique should continue to widen the applicability of carefully made and controlled steels of this variety.

The discussion period brought forth a number of questions on specific steel applications and developments which were capably handled by Mr. McQuaid.

Annealing, Cold Treating Practical Aspects Given

—Berlien

Reported by James C. Erickson
Deere & Co.

Tri-City Chapter—An address on "Practical Heat Treatment" given by G. B. Berlien, chief metallurgist, Lindberg Steel Treating Co., Chicago, at the December meeting was confined to annealing and cold treating.

Mr. Berlien subdivided his remarks on annealing into normalizing, stress relief treatment, full annealing and cycle annealing. His remarks on cold treating dealt with the practical applications of the treatment.

Chairman Major Paul Cunnick of Rock Island Arsenal introduced the speaker and led a lively discussion after the address.

A "Coffee Interlude" preceded the technical talk in the form of "Magic in the Modern Manner" by Don Sweet and Louise of East Moline.

REVIEW OF CURRENT METAL LITERATURE

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month

1. PRODUCTION OF METALS

1. Iron Concentration Tests Lick Hard-Water Problem. W. E. Keck and Paavo Maijala. *Engineering and Mining Journal,* v. 145, no. 1, Jan. '44, pp. 79-80.

Ore beneficiation research also finds way to float silica selectively without use of costly reagents in recovering hematite from a commercial washing plant tailing.

2. Possible Economies for Postwar Ore Reduction. Carle R. Hayward. *Engineering and Mining Journal,* v. 145, no. 1, Jan. '44, pp. 76-78.

Possible improvements are better materials-handling, maximum efficiency, more careful preparation of raw materials, fuel economies, improvement in design, better refractories, avoiding slag losses, and better handling of flue gases.

3. Reduce Postwar Milling Costs. A staff survey. *Engineering and Mining Journal,* v. 145, no. 1, Jan. '44, pp. 72-75.

Crushing costs can be lowered with more accurately-controlled feeding arrangements, use of better alloy steels, and improved crusher design. Grinding can be improved with a more efficient ball mill. Flotation design can enlarge the mechanical cell so large that 30 roughers and 10 cleaners could handle 25,000 tons daily of Morenci's Cu ore.

4. Ferro-Alloy Industry Keeps Pace with Production of All Types of Steel. George K. Herzog. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 70-72.

Brief survey of the ferro-alloy industry for 1943 with some discussion of changes made in the NE Steels during the year.

5. Iron and Steel Production and Practice in the Two World Wars. C. D. King. *Mining and Metallurgy,* v. 25, Jan. '44, pp. 14-17.

Pig iron manufacture, improved ore fineness; steel ingot manufacture, Bessemer practice.

6. The Physical Chemistry of Open-Hearth Slags. J. White. *Engineers' Digest,* v. 1, no. 1, Dec. '43, pp. 60-61.

Discusses basic oxide systems and binary systems of SiO_2 with the basic oxides; ternary systems of SiO_2 with two basic oxides. Information available on SiO_2 basic oxide higher than ternary.

7. Swedish Sponge Iron. Einer Ameen. *Iron Age,* v. 153, no. 3, Jan. 20, '44, pp. 55-59, 150.

Wiberg process of low temperature reduction of iron ore by CO gas regenerated from carbonaceous material in an electric furnace. The Söderfors Works has perfected a furnace of 11,000 net tons annual capacity which has been in continuous operation since 1941. A complete analysis of all factors to be considered if this process can be used in U.S.A. Also detailed cost data.

8. Metals and the War. Clyde Williams. *Metal Progress,* v. 45, no. 1, Jan. '44, pp. 67-72.

Steel manufacture, Mn, Cr alloy steels, substitute metals: Cu, Zn, Al, Mg and Be developments discussed.

9. Production of Aluminum From Clay. F. W. Libbey. *Mining Journal,* v. 27, no. 14, Dec. 15, '43, pp. 5-8.

Development on a commercial scale of the metallurgy for the recovery of alumina. High-alumina clays may be the backbone of the U. S. aluminum industry.

10. The Production of Aluminum From Blast Furnace Slags. Wilhelm E. Drebs. *Engineers' Digest,* v. 1, no. 1, Dec. '43, pp. 52-53.

Remelting of Bauxite in blast furnaces.

11. New Tungsten Process. *Science News Letter,* v. 45, no. 4, Jan. 22, '44, p. 52.

Pure, war-essential metal may be obtained directly from ore by electrolytic method which does not require preliminary transformation into alkali tungstate.

12. Liquid Steel Temperatures in Basic Open Hearth Furnaces. *Industrial Heating,* v. 11, no. 1, Jan. '44, pp. 78, 86.

Paper 23/'43 of the Committee on Heterogeneity of Steel Ingots, Iron & Steel Institute. Details of type of furnace and slag dealt with and temperature fluctuations during the progress of a heat.

13. Swedish Sponge Iron. Einer Ameen. *Iron Age,* v. 153, no 4, Jan. 27, '44, pp. 56-65.

Operating data on the perfected sponge iron furnace put into operation at Soderfors in 1941 and analyzes sponge iron production costs in minute detail with charcoal, wood or coke as the source of CO gas employed in the reduction process. Comparisons are also made of cost of pig iron produced in a shaft type electric furnace and the Tysland-Hole electric furnace. Cost data are also shown for carbon steel produced in the electric furnace with varying portions of sponge iron. Although the present unit is of 10,000 metric tons annual capacity, a 20,000-ton units is projected.

14. New Methods for the Production of Magnesium. L. M. Pidgeon. *Canadian Mining & Metallurgical Bulletin,* no. 381, Jan. '44, pp. 16-34 (Trans.).

Production methods and Canadian production.

15. Thermal Processes for the Production of Magnesium. D. D. Howat. *Engineers' Digest,* v. 1, no. 2, Jan., '44, pp. 11-17.

Hansgirg process, Permanente plant, and patented developments in thermal production and distribution of magnesium discussed. 3 ref.

2. PROPERTIES OF METALS

1. Diffusion of Indium in Bearings. A. A. Smith, Jr. *Metals Technology,* v. 11, no. 1, Jan. '44, Tech. Pub. 1640, 4 pages (disc. 2 pages).

Depth of diffusion of In is greatest in the Cd alloy, followed by Pb alloys. With Cu and sterling silver the depth of penetration of In was relatively slight. 8 ref.

2. Diffusion in Relation to Changes in Microstructure. Marie L. V. Gayler. *Metals Technology,* v. 11, no. 1, Jan. '44, Tech. Pub. 1648, 5 pages.

Annealing cast metal and followed by hot-working. Cold working followed by heat-treatment. Diffusion in metals and alloys is a process without which little use could be made of much available material. The rate of diffusion can be accelerated by various well-known methods.

3. Degassing of Metals. F. J. Norton and A. L. Marshall. *Metals Technology,* v. 11, no. 1, Jan. '44, Tech. Pub. 1643, 21 pages.

Apparatus and technique; temperature measurement; preparation of sample; nature of gas evolved at various temperatures; cleaning. Degassing W, Ni, C, Fe 18 ref.

4. Preface to Diffusion. Robert F. Mehl. *Metals Technology,* v. 11, no. 1, Jan. '44, Tech. Pub. 1658, 10 pages.

Rate of diffusion in liquid or solid metals or thin films; carburizing, decarburizing and nitriding; freezing of alloys; homogenization; diffusion in treatment of metals; electrical and analogue method; application to practical problems. 41 ref.

5. Influences of Gas-Metal Diffusion in Fabricating Processes. Frederick N. Rhines. *Metals Technology,* v. 11, no. 1, Jan. '44, Tech. Pub. 1645, 16 pages.

Nature of gas-metal diffusion; gases in molten metals; degassing of liquid metals; gas evolution in castings; gases in solid metals; hydrogen; surface and subsurface oxidation; oxidation of bi-metals; reduction of contained oxides; alternate oxidation and reduction; N and S. 13 ref.

6. Palladium: Its History and Properties. L. Sanderson. *Metallurgia,* v. 29, no. 169, Nov. '43, pp. 41-42.

The discovery and development of Pd are reviewed; various processes of extraction are described, and some of its mechanical and physical properties discussed. Reference is made to some of its applications.

7. Controlled Crystal Growth in Tantalum Ribbons. Adalbert B. Mrowca. *Journal of Applied Physics,* v. 14, no. 12, Dec. '43, pp. 684-689.

Microscopic examination of surfaces developed in tantalum ribbons on heat treatment in vacuum. Modification of surface structure results due to recrystallization over a temperature range of 1900° K to 2500 °k. Grain growth is shown to increase exponentially with the temperature.

8. Thermal Stresses in Ingot Molds. *Industrial Heating,* v. 11, no. 1, Jan. '44, p. 80.

Stresses in a long circular mold calculated; Theory of stresses; molds on non-circular section; end effects; surface stresses calculated from measurement of temperature and expansion of outer mold surface; detailed mathematical analysis of stresses in long circular molds. Abstract of Paper 20/'43, Committee on Heterogeneity of Steel Ingots, Iron & Steel Institute.

9. The Structure and Segregation of Two Ingots of Ingot Iron, One Containing Lead. L. Northcott. *Metallurgia,* v. 29, no. 169, Nov. '43, pp. 30-32.

Chemical analysis, microstructure, machinability, mechanical properties, and X-ray examination of ingot iron with and without addition of lead. Paper released at autumn meeting of iron and steel institute.

3. PROPERTIES OF ALLOYS

1. High-Silicon Acid-Resisting Cast Iron. J. E. Hurst. *Foundry Trade Journal,* v. 71, no. 1425, Dec. 9, '43, pp. 283-289. (Also *Iron and Steel,* v. 17, no. 4, Dec. '43, pp. 181-185.)

Corrosion resistance; mechanical and physical properties; effects of carbon, gas content and temperature; annealing and welding.

2. Mechanical Properties of Iron-Phosphorus Alloys. *Iron and Steel,* v. 17, no. 4, Dec. '43, pp. 192-193.

C-free Fe-P alloys containing 0.12%-0.86% P made to cold roll. 0.65% P could be rolled with care. 0.86% could not be rolled. Physical properties listed. 3 ref.

3. Strength Properties of Aluminum-Copper-Magnesium Wrought Alloys with About 2% Copper and Various Magnesium and Silicon Content After Cold and Hot Hardening. K. L. Dreyer and Max Hansen. *Zeitschrift für Metallkunde,* v. 35, no. 7, July, '43, pp. 137-146.

Alloys with different Mg content and small Si content; alloys with high Mg content and different Si additions.

4. High Strength Structural Steels. G. P. Contractor and S. Visvanathan. *Engineers' Digest,* v. 1, no. 1, Dec. '43, pp. 25-26.

Physical properties of Tiscor Steel.

5. The Constitution of Magnesium-Manganese-Zinc-Aluminum Alloys in the Range 0-5 Per Cent. Magnesium, 0-2 Per Cent Manganese, and 0-8 Per Cent Zinc. iv. The Equilibrium Diagram Below 400° C. A. T. Little, G. V. Raynor and W. Hume-Rothery. *Journal, Institute of Metals,* v. 69, Nov. '43, pp. 467-493.

Diagrams and methods of calculation are given by means of which some of the phase-field boundaries in the quaternary system can be deduced. 14 ref.

6. Constitution of Silver-Magnesium Alloys in the Region 0-40 Atomic Per Cent Magnesium. K. W. Andrews and W. Hume-Rothery. *Journal, Institute of Metals,* v. 69, Nov. '43, pp. 485-493.

Some evidence was obtained for the existence of a super-lattice in the alpha phase in the region of 25 atomic %. Mg in slowly cooled alloys annealed at low temperatures. 14 ref.

7. Lead-Base Bearing Metals. *Metal Industry,* v. 63, no. 22, Nov. 26, '43, p. 339.

Suitability of lead-base alloys to replace Sn-base alloys as bearing linings.

PHOTOSTAT copies of any of the articles contained in this Literature Review are available upon request. Cost is 35¢ per page and can be computed from the number of pages given in the annotation. Inasmuch as this photostating service is provided at cost, remittance should accompany the order. Address your request to the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

8. Effects of Precipitation Treatment of Binary-Magnesium-Aluminum Alloys. F. A. Fox and E. Lardner. *Metal Industry,* v. 63, no. 23, Dec. 3, '43, pp. 363-364.

Mechanical properties of the alloys as affected by the precipitation treatments.

9. Effects of Precipitation Treatment of Binary Magnesium-Aluminum Alloys. F. A. Fox and E. Lardner. *Metal Industry,* v. 63, no. 22, Nov. 26, '43, pp. 340-342.

Description of main forms of beta precipitation in treatment of binary Mg-Al alloys and the factors influencing rate of precipitation.

10. Effects of Precipitation Treatment of Binary Magnesium-Aluminum Alloys. F. A. Fox and E. Lardner. *Metal Industry,* v. 63, no. 21, Nov. 19, '43, pp. 322-325.

Metallographic examination of binary Mg-Al alloys in the solution-treated and precipitated state shows that 4 general forms of precipitate are produced. The higher the temperature and the longer the time the coarser is the form of the precipitate, the best mechanical properties being obtained when the precipitate is fine.

11. The Fabrication and Treatment of Nickel and High-Nickel Alloys. W. A. Mudge. *Canadian Mining & Metallurgical Bulletin,* no. 380, Dec. '43, pp. 506-634.

Ni alloyed with Cu, Si, Cr, Fe, and Mo. Mechanical properties, hot and cold working methods outlined. 20 ref.

12. Leaded-Manganese-Molybdenum Steel. T. Swinden. *Metallurgia,* v. 29, no. 169, Nov. '43, pp. 26-30.

Tests have been carried out on material from a non-leaded and a leaded ingot of Mn-Mo steel in order to determine the effect of Pb (0.19%) on the mechanical properties including the machinability; grain size and hardenability are also compared.

13. Metallurgical Investigations of Some Light Alloy Pistons from German Aircraft. C. Wilson. *Metallurgia,* v. 29, no. 169, Nov. '43, pp. 33-36.

Composition, mechanical properties, hardness tests, macro- and microstructure.

14. Metallic Materials. H. W. Gillett. *Steel,* v. 114, no. 3, Jan. 17, '44, pp. 84-92.

Standard procedures inadequate to appraise properties of metals needed in bearings. Various types of bearing materials analyzed. (To be cont.)

15. Note on the Relation Between Hot Tearing and Micro-porosity Effects in a Magnesium Alloy. G. Goddard. *Magnesium Review,* v. III, no. 4, July '43, pp. 98-101.

Tests indicate that the Mg-base alloy containing 6% Al, 3% Zn is able to withstand quite considerable stresses while hot without forming tear-cavities.

16. Some Experiments on Additions of Calcium to Reduce Solution-Treatment Times for Magnesium Alloys. G. Goddard. *Magnesium Review,* v. III, no. 4, July '43, pp. 83-92.

A series of pilot heat-treatments to assess the temperatures of intergranular fusion of two selected alloy types with added Ca varying from zero to approximately 0.6%. Also to ascertain the times for possible single step high-temperature solution treatments, and to examine tensile properties of sand-cast test bars so treated.

17. Effect of Some Elements on Hardenability. Walter Crafts and John L. Lamont. *Metals Technology,* v. 11, no. 1, Jan. '44, Tech. Pub. 1657, 11 pages.

Hardenability multiplying factors for the calculation of ideal critical diameter according to Grossmann's principle for various metals. The consistent manner in which the alloys affect hardenability confirms the validity of Grossmann's method of calculating ideal critical diameter. 6 ref.

18. Effect of Several Variables on the Hardenability of High-Carbon Steels. E. S. Rowland, J. Welchner, and R. H. Marshall. *Metals Technology,* v. 11, no. 1, Jan. '44, 12 pages.

Effects of time at temperatures from 0 min. to 4 hr. and quenching temperatures from 1450° to 1700° F. on the end-quenched hardenability values were determined from normalized and spheroidized prior structures. 11 ref.

19. Diffusion in Alclad 24S-T Sheet. F. Keller and R. H. Brown. *Metals Technology,* v. 11, no. 1, Jan. '44, Tech. Pub. 1659, 10 pages.

Very little Cu will reach the surface of Alclad 24S sheet by diffusion when a temperature of 800° F. or lower is used. Any treatments for annealing or aging will not cause a significant amount of diffusion. When material is quenched less rapidly, the amount of diffusion to the surface will be important if it changes the potentials to the point where sufficient electrochemical protection is no longer obtained. 8 ref.

20. Physical Metallurgy of Copper and Copper-Base Alloys. P. H. Brace. *Electrical Engineering,* v. 63, no. 1, Jan. '44, pp. 11-17.

Illustrations of certain basic metallurgical phenomena determining properties and performance of some of the more specialized alloys with particular reference to the effects at elevated temperatures. 9 ref.

21. Making Beryllium-Copper Behave. Robert W. Carson. *Metals and Alloys,* v. 18, no. 6, Dec. '43, pp. 1314-1319.

Development in U. S., heat treatment, spring properties, advantages and limitations. 9 ref.

22. The Hardenability of Steel. A. J. K. Honeyman and J. Glen. *Steel Processing,* v. 29, no. 12, Dec. '43, pp. 629-631.

Calculation of hardenability from heat transfer factor.

23. Improving the Physical Properties of Steel. *Steel Processing,* v. 30, no. 1, Jan. '44, pp. 33-35.

Effect of a special addition agent on the hardenability, tensile properties and impact strength of steel made to specification NE 9440.

24. The Metallurgy of Modern Alloys: Part IIIB. The Role of Strain in Precipitation Reactions in Alloys. R. H. Harrington. *Steel Processing,* v. 30, no. 1, Jan. '44, pp. 41-44.

The classification of the strain in precipitation hardening; IA—precipitation with thermal elastic and plastic strain from the solution quench preceding the precipitation reheat; IB—hardening with mechanical plastic (cold work) intermediate to the solution quench and the precipitation reheat. 6 ref.

Review of Current Metal Literature—(Continued)

25. Fatigue Strength of Nitrided Surfaces. *Iron Age*, v. 153, no. 4, Jan. 27, '44, p. 55.

Effects of case hardness, case depth, degree of cleanness, stress concentration and corrosive influence on the fatigue strength of nitrided specimens of chromium-molybdenum steels.

26. The Problem of Reduction of Vibrations by Use of Materials of High Damping Capacity. Andrew Gemant. *Journal of Applied Physics*, v. 15, no. 1, Jan. '44, pp. 33-42.

The reduction in amplitude of unwanted vibrations of machinery parts through the use of materials of high damping capacity. The problem is to reconcile the requirement for high damping with that for high mechanical quality (strength, fatigue resistance, etc.). Two ways are suggested: (1), the use of a material whose decrement generally is low but rises rapidly as the stress increases; (2) the use of a material whose damping capacity is low but rises to high peaks in certain frequency ranges. It is shown by numerical computation in two instances, namely, turbine blade vibrations and crankshaft oscillations in engines, how the suggested methods would work out in practice. 16 ref.

4. STRUCTURE

1. X-Ray Crystallography. Arthur G. Barkow. *Industrial Radiography*, v. 11, no. 2, Fall '43, pp. 24-25, 28-30.

A resume of the important fundamentals of crystal structure.

2. Pseudomorphs of Pearlite in Quenched Steel. Owen W. Ellis. *Canadian Metals & Metallurgical Industries*, v. 6, no. 12, Dec. '43, pp. 24-27.

Induction heating provides the means for raising the temperature of steel so rapidly that the point is almost reached where the steel, after heating, can be quenched before any change has occurred in it, other than that of alpha iron to gamma iron. 6 ref.

3. Block Structure of Cadmium Single Crystals. Hans Mahl and Iwan N. Stranski. *Zeitschrift für Metallkunde*, v. 35, no. 7, July '43, pp. 147-151.

Valuation of the electron microscope absorption of Cd single crystals.

5. POWDER METALLURGY
Process and Product

1. Some Modified "Heavy Metal" Alloys—Effect of Composition on Properties. H. H. Hausner. *Metals and Alloys*, v. 18, no. 6, Dec. '43, pp. 1335-1338.

Physical and electrical properties of high-density W-Ni-Cu powder metallurgy "alloys". 5 ref.

2. Introduction to Powder Molding. Irving D. Press. *Tool & Die Journal*, v. 9, no. 10, Jan. '44, pp. 78-85.

Description and chart of press and die. Die and product design consideration; lateral flow and powder distribution; die design: Simplicity vs. cost; press selection.

6. CORROSION

1. Investigations of Stress Corrosion. G. Wasserman. *Metal Industry*, v. 63, no. 22, Nov. 26, '43, p. 346.

Results of tests for stress corrosion on an Al alloy.

2. Metallic Materials. H. W. Gillett. *Steel*, v. 114, no. 2, Jan. 10, '44, pp. 98-108.

Special tests for such factors as corrosion and wear resistance.

3. Bakelite Board as a Source of Corrosion. H. L. Halstrom. *Engineers' Digest*, v. 1, no. 2, Jan. '44, p 114.

An explanation of bakelite as the cause of corrosion of metals under certain conditions even though considered a stable material.

7. PROTECTION

1. Surface Treatments for Magnesium, Pt. 2. E. R. Holman and J. P. ApRoberts. *Metals and Alloys*, v. 18, no. 6, Dec. '43, pp. 1331-1334.

Chemical processes, plating procedure and organic coatings.

2. Diffusion in Chromizing. I. R. Kramer. *Metals Technology*, v. 11, no. 1, Jan. '44, Abst.

Corrosion resistance of the chromized layer is high, and these steels offer some advantages over other corrosion-resisting coatings or alloys. Chromizing process uses soft or low alloyed steels that can be easily hot or cold formed and since the chromized layer is soft and adherent, these parts can be subjected to cold deformation without spalling or chipping.

3. Finish-O-Phobia. III. Paul O. Blackmore. *Die Casting*, v. 3, no. 1, Jan. '44, pp. 38-42.

Primers, though covered by a finishing coat, are vitally important. Users and formulators need to take into account characteristics of both the priming coat and the metal to which it is applied.

4. Jigs and Tools for Anodising. G. O. Taylor. *Metallurgia*, v. 29, no. 169, Nov. '43, pp. 7-10.

Designs for jigs and tools are described that can with advantage be added to the equipment of an anodic oxidation plant to speed up production and reduce labor and material costs.

5. Winning the War on Wear. John A. Gallaher. *Welding Engineer*, v. 29, no. 1, Jan. '44, pp. 45-49.

Hard facing permits use of equipment in service despite abrasion, corrosion, heat, impact and thermal shock.

6. Some Considerations in the Choice of Hard-Facing Metals. Jim Medford. *Petroleum World*, v. 41, no. 1, Jan. '44, pp. 42-45.

Hard-facing alloys require more than mere hardness to be wear resistant. Prolonged research has taught Stoody engineers what characteristics are required and why.

7. Anodic Films on Aluminum Alloy Parts on German Aircraft. *Foundry Trade Journal*, v. 71, no. 1427, Dec. 23, '43, p. 329.

Anodic treatment of aluminium aircraft parts in Germany has been described in an article in *Dornier Post.* The conditions of operation are 15 to 20 amp. per sq. ft., 11 to 22 volts, 16 to 24° C., and sulphate of aluminium content of bath not greater than 45 grams per liter. Hot potassium dichromate solution (90 to 95° C.) is used to seal the films.

8. Anodic Films. *Aircraft Production*, v. 6, no. 63, Jan. '44, p. 48.

An examination of aluminium alloy parts from German aircraft.

9. Hard-Facing in the War on Wear. John A. Gallaher. *Welding Journal*, v. 23, no. 1, Jan. '44, pp. 16-24.

Properties of the various hard-facing alloys and the kind of wear that each type of alloy can best combat. Selection of the hard-facing material, selection of the base material, preparation of the part for hard-facing and application of the hard-facing material.

10. Tinning of Light Metals by Means of Ultrasound. A. E. Thiemann. *Engineers' Digest*, v. 1, no. 1, Jan. '44, p. 88.

A new process consists in dipping the aluminium sheet into a bath of molten tin, at the same time contacting the sheet with an ultrasound generator. The ultrasound vibrations transmitted to the aluminium sheet in this way are in turn transmitted to the tin film surrounding the sheet. The enormous accelerations and decelerations hereby imparted to the tin particles serve to remove the adherent layer of oxide, its place being taken by a layer of tin intimately bonded with the virgin aluminium surface.

11. Metallizing. Norman Clarke Jones. *Society of Chemical Industry*, v. 62, no. 51, Dec. 18, '43, pp. 481-482.

Spraying molten metal onto worn machine parts; Metallizing is carried out by means of a portable gun, which can be held and operated by hand, or secured in the tool post of a lathe.

12. Procedures for Testing Metallizing Bond. H. Ingham and K. Wilson. *Iron Age*, v. 153, no. 4, Jan. 27, '44, pp. 44-49.

In an effort to standardize testing methods for the adherence strength of sprayed metals, the authors have worked out two procedures: One is a test for shear strength, the other for tensile strength, since both shear and tension affect bond strength.

8. ELECTROPLATING

1. Chromium Plating. Wm. Whalen. *Steel*, v. 114, no. 3, Jan. 17, '44, pp. 103, 120-121.

Use of hard chromium for prolonging tool life.

2. Republic's Electrolytic Tin Plate Line Starts Production. George R. Reiss. *Steel*, v. 114, no. 2, Jan. 10, '44, pp. 92-96.

In these plating cells the strip runs between contact rolls with vertical bus bar, connecting anodes; chemical treatment tank beneath rolls removes oxide film from brightened tin surface and applies thin adherent film which improves enamel adhesion and retards discoloration during baking operation; induction melting unit melts tin deposit and fuses it to steel base of strip; on top deck of plating section strip passes through a spray rinse. Recovery operation minimizes loss of plating solution containing valuable dissolved tin.

3. Fundamentals of Chemistry for Electroplaters. III. Atomic Structure of Matter. Samuel Glasstone. *Monthly Review, American Electroplaters Society*, Jan. '44, pp. 17-20.

Combination of atoms by whole numbers, atomic weights, constant composition of compounds.

4. An Electroplating Library—Revised and Amplified. George B. Hogaboom, Sr. *Metal Finishing*, v. 34, no. 1, Jan. '44, pp. 14-15.

Supplement to list which was published in *Metal Finishing*, July, 1943.

5. New Plating Process for Aircraft Instruments. *Products Finishing*, v. 8, no. 4, Jan. '44, p. 50.

Alloy of Cu, Sn and Zn developed for plating Cu or brass parts of aircraft instruments.

6. Feathering the War Birds. Jeffrey R. Stewart. *Products Finishing*, v. 8, no. 4, Jan. '44, pp. 40-48.

Questions and answers on problems encountered in the finishing of military aircraft.

7. Cadmium Plating Aircraft Parts. Fred M. Burt and C. L. Savage. *Products Finishing*, v. 8, no. 4, Jan. '44, pp. 18-26.

Method of plating aircraft parts with cadmium used in one of the Douglas Aircraft Co. plants.

8. The Chemistry of Electroplating. C. B. F. Young. *Products Finishing*, v. 8, no. 4, Jan. '44, pp. 28-38.

Chemical equations and calculations for use in electroplating.

9. Electrolytic Tin Plate. K. W. Brighton. *Canadian Metals & Metallurgical Industries*, v. 7, no. 1, Jan. '44, pp. 21-24.

Its use in can manufacture. History, Sn conservation program, enamel adhesion and testing, chemical treatment, lubrication of electrolytic plate, soldering. 4 ref.

10. The Salt Spray Test for Electrodeposited Metallic Finishes. C. H. Sample. *Metal Industry*, v. 63, no. 26, Dec. 24, '43, pp. 410-412.

The salt spray test cannot be recommended as a quality test for electronegative type coatings. When thoroughly standardised and properly conducted the salt spray test is frequently useful in evaluating the degree of porosity of electrodeposited metallic coatings of the electropositive type. The time of exposure to the salt spray required to reveal a certain degree of porosity varies with the coating-basis metal combination being tested and should be correlated with actual exposure tests. The time required for "first rust" to appear is not as important as the appearance of the coating after a given length of time in the salt spray. The lack of experimental data correlating salt spray and service behaviour of the wide variety of coating-basis metal combinations would indicate that except for revealing particularly inferior coatings the test does not merit its current extensive use in specifications.

11. The Repair of Worn or Over-Machined Parts by Electrodeposition. *Machinery (London)*, v. 63, no. 1628, Dec. 23, '43, p. 715.

1. Hardness and thickness of deposits.

9. ELECTROMETALLURGY

1. Electrolytic Production of Cobalt. *Metallurgia*, v. 29, no. 169, Nov. '44, pp. 37-40.

Recent work on this subject is reviewed. 7 ref.

10. ANALYSIS

1. Spectrographic Flat Surface Sparking Technique of Steel Analysis. Charles L. Guettel. *Journal, Optical Society of America*, v. 34, no. 1, Jan. '44, pp. 41-46.

Spectrographic, routine testing laboratory method of steel analysis involving a flat surface sparking technique.

2. Use of Briquets Formed from Metal Grindings for the Spectrographic Analysis of Steel. R. E. Nusbaum and J. W. Hackett. *Journal, Optical Society of America*, v. 34, no. 1, Jan. '44, pp. 33-40.

¼" briquets are formed from particles smaller than 150 mesh, obtained by grinding. These particles are separated from the metal grindings by a magnetic or an electrostatic separator. 2% C is added, and the particles are then pressed into a briquet with a pressure of 163,-000 psi. Spectrographic analysis of the briquet; comparison of briquets and rods; suppression of effects of segregation; preparation of a series of standards.

3. Hardness Measurement as a Rapid Means for Determining Carbon Content of Carbon and Low-Alloy Steels, by K. L. Clark and Nicholas Kowall. *Metals Technology*, v. 11, no. 1, Jan. '44, 5 pages.

Method described is satisfactory for C control during melting of plain C and low-alloy steels as (1) results are reproducible and sufficiently accurate (2) testing procedure is rapid (3) method simple to use and (4) calibration of hardness testing equipment can be checked easily and quickly. 9 ref.

4. Sulphur Extracted from Coke Oven Gas by the Ammonia Thylox Method. *Blast Furnace and Steel Plant*, v. 32, no. 1, Jan. '44, pp. 119-120.

Operation of apparatus for extracting sulphur from coke oven gas.

5. Gravimetric Determination of Tungsten. John H. Yoe and A. Letcher Jones. *Industrial & Engineering Chemistry*, v. 16, no. 1, Jan. '44, pp. 45-48.

A new organic compound has been developed as a reagent for the gravimetric determination of tungsten. Its physical and chemical properties have been investigated and procedures are given for its use in the determination of tungsten in ores and alloys. Determinations of tungsten with the new reagent are equivalent in accuracy to the standard cinchonine method.

6. Polarographic Determination of Copper, Lead and Cadmium in High-Purity Zinc Alloys. R. C. Hawkings and H. G. Thode. *Industrial & Engineering Chemistry*, v. 16, no. 1, Jan. '44, pp. 71-74.

A study has been made on the application of the polarographic method of analysis in determining trace elements (down to 1 x 10^{-4}%) found in zinc-base die casting alloys. Trace amounts of lead, cadmium, and tin cause intergranular corrosion which results in a serious weakening of the alloy. A polarographic procedure has been developed for the direct determination of copper, cadmium, and lead in these alloys. The samples are dissolved in hydrochloric and nitric acids, evaporated to near dryness, redissolved, treated with hydroxylamine hydrochloride, and finally diluted to volume. The solution is then electrolyzed cathodically over a range of approximately 0.8 volt to obtain waves for copper, lead, and cadmium. Using an 8-gram sample in 50 ml. of solution, these elements can be determined with a precision of = 1 x 10^{-4}% of the sample weight.

11. LABORATORY APPARATUS, INSTRUMENTS

1. Designing Electronic Control Devices. W. D. Cockrell. *Machine Design*, v. 16, no. 1, Jan. '44, pp. 140-144.

Rectifiers, the electronic amplifier, oscillators, gas-filled tubes, plasma potential, and electronic-control circuits.

2. A Metallurgical Study of Enemy Aircraft Components. *Metal Industry*, v. 63, no. 25, Dec. 17, '43, pp. 395-396.

Investigations on various control units. A wide range of materials has been employed for both bellows and capsule types of units. Beryllium copper was used in one instrument only out of eleven examined, and also for Bourdon gauge tubing, but otherwise materials correspond closely with those used in British instruments.

3. New Gage System. G. W. Birdsall. *Steel*, v. 114, no. 2, Jan. 10, '44, pp. 74-75.

Measures any angle from zero to 103° at 1-sec. intervals with an accuracy of ¼ sec.

4. Electrolytic Polishing of Metallographic Specimens. L. A. Hauser. *Iron Age*, v. 153, no. 3, Jan. 20, '44, pp. 48-54.

Smooth, scratch-free surfaces are produced with no disturbed metal. To encourage use of this rapid and economical polishing method, detailed data on the apparatus and procedures are presented.

5. A Compact High Resolving Power Electron Microscope. V. K. Zworykin and James Hillier. *Journal of Applied Physics*, v. 14, no. 12, Dec. '43, pp. 659-673.

Needed qualities in electron microscope, experimental design of a small electron microscope, specimen stage, lens and vacuum system, and power supplies.

6. Magnification Calibration of the Electron Microscope. Ernest F. Fullan. *Journal of Applied Physics*, v. 14, no. 12, Dec. '43, pp. 677-683.

Magnification calibration of the electron microscope to compensate for the calibration errors caused by mechanical and electrical variation of the instrument. Microscopic glass spheres of predetermined size, mounted directly on the specimen supporting film.

7. Magnetic Comparator. *Business Week*, no. 751, Jan. 22, '44, p. 69.

New instrument to control quality of ferrous parts by detecting differences in heat treatment, composition, hardness, size, or other properties which affect behavior in a magnetic field.

8. Wax Impregnated Broadcloth Superior for Rough Polishing. Louis A. Nowell, Jr. *Metal Progress*, v. 45, no. 1, Jan. '44, pp. 89-90.

Broadcloth dipped in melted paraffin and treated with levigated alumina containing a small quantity of liquid soap to make the solution adhere to the wax.

(Turn to page 6)

THE REVIEW

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Ray T. Bayless....................Editor
M. R. Hyslop....................Managing Editor

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Metal Literature Listed, Annotated In New Survey

(Continued from page 1)

subscription or from the local library. However, those articles that are not available can be secured in photostat form at cost as indicated in the boxed notice on page 2.

It is believed that this service will prove not only a great time-saver in enabling the member to review quickly all of the literature published during the past month in his field, but also, if each issue is retained, he will at the end of the year have a valuable permanent library record of published literature classified by subject and cross-indexed by materials.

There is, of course, quite a dearth of foreign publications now being received and those that do arrive are generally late. However, they will be reviewed as promptly as they are received.

Of this you may be sure—all articles are being reported and listed for you. You may be confident when you look over each section or sections in which your major interests lie that every worth-while article printed during the past 30 days has been listed and annotated for your attention.

—V—

Hard Cast Alloy Tools Operate Up to 1650° F.

—Fraser

Reported by F. N. Meyer
American Brass Co.

New Haven Chapter—George T. Fraser, of the Rexalloy Division, Crucible Steel Co. of America, told a large and interested group of members about the useful characteristics of hard cast alloy tools at the meeting on Nov. 22.

This material is produced by melting the proper proportion of cobalt, chromium and tungsten, usually 44%, 33%, and 17% respectively, in an induction furnace, and casting in semi-permanent molds to the specific shape and size desired. Since the material cannot be machined it is usually cast close to size and then ground to the finish dimensions.

The speaker emphasized the service conditions required for maximum efficiency in use of such tools, such as increasing surface speed 30% over that used for high speed steel tools, and using relatively heavy feeds and cuts since they are primarily roughing tools.

Cast alloy tools retain their hardness up to a temperature of about 1650° F.; above this point the hardness will drop one or two points. It is not unusual to operate these tools at a cherry red.

Further emphasis was laid on grinding cast alloy tools to the proper clearance and rake angles, grinding with the proper abrasive, and finishing the tools by honing the burr from the cutting edge.

Mr. Fraser concluded with a demonstration of tipping; using an oxy-acetylene torch, he brazed a cast alloy tip on a shank, employing a silver brazing alloy and flux. The job was done with neatness and dispatch, emphasizing the simplicity of this operation.

Shows Nature Of Tempering Phenomena

—Zmeskal

Reported by J. B. Caine
Sawbrook Steel Castings Co.

As a logical sequel to McGuire on quenching, Cincinnati's educational group studied tempering under the direction of Dr. Otto Zmeskal, research metallurgist of the Universal-Cyclops Steel Corp.

Dr. Zmeskal stressed the fact that tempering is not just a gradual decomposition of austenite and softening of martensite, but consists of a series of definite physical changes in the steel, occurring over fixed temperature ranges for each individual steel, which are, however, time dependent.

Stress Relief Important

The austenite present decomposes into ferrite plus carbide, this carbide not being Fe_3C but probably Fe_xC, where x is greater than 3. The unknown compound, Fe_xC then transforms to Fe_3C at definite temperatures depending on composition and heat treatment.

Superimposed upon the crystallographic changes occurring in the steel itself during tempering is the independent variable, stress. Stress relief occurring during tempering cannot be neglected, as stress imposed during quenching is of utmost importance in determining the physical properties of the heat treated part.

Retained Austenite Undesirable

In the discussion it was agreed that the advisability or inadvisability of retaining austenite on the quench is intimately tied up with stress. During the quench retained austenite, with its low yield point, deforms and acts as a cushion for the hard brittle martensite and is therefore beneficial. All the retained austenite should be transformed to martensite during the tempering treatment, since retained austenite decreases the fatigue strength and is especially detrimental in tool steels because it lowers the red hardness.

If sub-zero temperatures are used to eliminate retained austenite in highly alloyed steels it is necessary that the part be cooled to the low temperature as soon as possible after the quench. The transformation of very stable austenite at these low temperatures depends not only on the temperature, but also on time.

If the part is allowed to stand at room temperature for, say, a couple of hours, it is probable that the sub-zero treatment will not transform all the austenite and retained austenite will be present in the part in service.

Describes Researches on Improved Welding Methods

—Hess

Reported by W. A. Mudge
The International Nickel Co., Inc.

New York Chapter—The lecture by Prof. Wendell F. Hess of the Rensselaer Polytechnic Institute, Troy, N. Y., on Jan. 10 was heard by a large and enthusiastic audience. William Spraragen, executive secretary of the Welding Research Council and editor of *The Welding Journal*, presided.

Dr. Hess outlined some of his researches which have led to improved welding of light aluminum and magnesium alloys, stainless steels, high nickel alloys, low alloy steels and carbon steels, and described equipment which has been developed to meet the improved technique.

For the precipitation-hardening aluminum alloys, which can overage readily, investigations showed that a short-time heating period was desirable. Stored-energy machines have been built to meet the conditions imposed by low electrical resistivity and high thermal conductivity of the metal and the necessary high-power electrical conditions required for welding.

Surface preparation is extremely important and new chemical methods for the purpose were outlined.

The light magnesium alloys are welded successfully by the Heliarc process; resistance welding methods are being studied and offer a promising future.

Tempering Improves Properties

Dr. Hess stressed the fact that stainless steels can be spot welded to have tensile strengths greater than 200,000 psi. and elongations of 10% and can therefore be made to compete favorably with the light aluminum alloys on a strength-weight ratio basis.

For many, the recital of the improvements in spot welding and tempering of carbon and low alloy steels was the high spot of the evening. Well-prepared slides were used to show that tempering for as little as a small fraction of a second, after controlled cooling from the welding temperature, has resulted, with 0.20% carbon steels, in improvements of 10% in shear strength, 300% in tensile strength and 200% in impact strength.

With 0.30% carbon steels, the improvements were 50, 300, and 500% respectively; with 4130 steel, the improvements were 250, 550, and 500% respectively; and, finally, with 0.48% carbon steel, improvements of 300% in shear, 1000% in tension and 950% in impact were secured.

Dr. Hess emphasized that results like these offered great opportunities for post-war developments, particularly for the production of high strength structural materials for aircraft and transportation, at a very low cost.

The question period that followed the lecture was long and interesting.

Cleveland Chapter Charter Member Dies Suddenly

Death came to LAWRENCE H. DUNHAM, a charter member of the Cleveland Chapter A.S.M., just a few days before he was to join in the celebration of the Chapter's Silver Anniversary. Mr. Dunham, who was assistant manager of the Metallurgical Department of the American Steel & Wire Co., died suddenly in Pittsburgh on Jan. 19.

Mr. Dunham was born in 1891 and was graduated from the University of Illinois in 1915 with a B.S. degree in chemical engineering and metallurgy. He began working for the American Steel & Wire Co. in 1916 as a laboratory assistant in Cleveland. In 1919 he was made laboratory director and in 1928 assistant to the chief metallurgist in the main office in Cleveland.

In 1937, Mr. Dunham was transferred to Chicago as a district metallurgist and three years later was made works metallurgist at the Waukegan, Ill., Works. He was made assistant manager of the metallurgical department in April 1942.

Mr. Dunham was also a member of the American Iron and Steel Institute, the American Society for Testing Materials and the American Welding Society.

—V—

Sorbitic Structures Rapidly Produced By Induction Machine

—Osborn

Reported by Charles Nagler
University of Minnesota

North West Chapter—A talk on "Induction Hardening" by the well-known "Tocco" expert, Ohio Crankshaft's research and development engineer, H. B. Osborn, Jr., was the excellent fare provided for the December meeting.

Dr. Osborn's talk, which has been reviewed in detail in past issues of THE REVIEW, was illustrated with a number of slides showing many applications in the present war effort.

He also pointed out many of the economies which have resulted from the adoption of induction hardening and tempering; an interesting example is the production of sorbitic structures in steel in a Tocco-built machine. Steel bars can be heated above the critical, quenched to full martensite, and then tempered to sorbite within a short length of time as the bar passes progressively through the Tocco machine.

In this inductive method of heating and subsequent tempering, the parts do not scale and have a uniform structure from bar to bar and throughout the entire cross-section. Quality is unquestionable and cost only half that of present mill charge.

—V—

Named Advertising Manager

Tube Turns and the Girdler Corp., Louisville, Ky., announce the appointment of Gene Wedereit as advertising manager. He was formerly vice-president and director of creative service with the E. F. Schmidt Co., Milwaukee.

Walter Girdler, Jr., formerly advertising manager, is now director of personnel.

Proper Selection, Heat Treatment Cut Tool Failures

—Kells, Grimshaw

Reported by Stewart M. DePoy
Metallurgist, Delco Products Div., G.M.C.

Dayton Chapter—Ray P. Kells and Leonard C. Grimshaw of the Latrobe Electric Steel Co., gave a thorough and informative lecture on "Factors to be Considered in Reducing Tool Failures" at the January meeting.

L. C. Grimshaw

Mr. Grimshaw, metallurgist at Latrobe, gave the first part of the lecture, which consisted of a prepared paper covering methods of proper selection and heat treatment of various tool steels.

By simplified S-curves he was able to explain many of the failures common in present-day industrial plants, which are due to slightly improper heat treatment. By these curves he revealed the necessity for heating far above the critical temperature of the highly alloyed tool steels to get ultimate solution.

R. P. Kells

The second part of the evening was taken over by Mr. Kells, who is chief service engineer at Latrobe. He gave many apt examples of improper selection and heat treatment of tool steels, vividly illustrated by lantern slides.

An interesting question and answer period followed, in which many problems that had been bothering tool engineers and metallurgists in this district were relieved by Mr. Kells' frank and "straight to the point" answers.

The interest in the subject presented was shown by the attendance of 160 members and guests, representing the largest crowd of the season to date.

Four Major Tests Given To Detect Defects in Steel

(Continued from page 1)

tion. It is desirable to know the ingot structure, to determine the best procedure for cogging.

It is necessary to forge certain compositions, particularly the high chromium-nickel steels, and to allow additional heating time. Definite heating cycles are necessary for each grade of ingots, blooms, billets and slabs.

Correcting Specific Defects

Some specific defects were then described. Longitudinal cracks may occur in chrome-nickel and chrome-molybdenum steels unless a stress relief treatment at approximately 1250° F. is given.

Tears occur in high sulphur steel and ingot iron if rolled in the range 1500 to 1750° F. Crow's feet result from continuous rolling of tears.

Slivers result from defects carried over from the ingot. Flake may be prevented by cooling to 600° after rolling or forging, then reheating to just under the lower critical and air cooling.

Carbon segregation may be caused by a pipe eliminator that reacts exothermically. Heterogeneity increases with the size of ingot. Nonmetallic inclusions usually etch deep, while metallic segregates do not. Bleeding may be caused by water in green tar mold coating.

Some additional common bar defects include guide scratches, overfills, diamond and oval shape, and ruptured corners, and may be corrected by proper design and adjustment of rolls or stock.

Cracked ends result from too cold shearing, and are minimized by small grain and maximum softness. Often heating the bars in hot water will prevent shear cracking. Ruptured surfaces are usually caused by burning or overheating, resulting in oxide in grain boundaries and hot shortness.

Internal tears on some of the stainless types are prevented by increasing manganese content, and so reducing the delta iron to less than 5%. Non-uniform heating with cold centers may also cause ruptures in the steel.

In the discussion that followed it was brought out that the Zyglo test on austenitic stainless steels discloses defects not easily shown by macro-etch.

After the technical session, musical entertainment was provided by George J. Stevens, chairman of the entertainment committee, and several of his co-workers at Rustless Iron and Steel.

Refining of Bullion and Coin Manufacture Detailed

—LaFollette

Reported by R. Wayne Parcel
Metallurgist, Denver & Rio Grande Western R.R. Co.

Rocky Mountain Chapter—"The Manufacture of Coin at the Denver Mint" was the title of an absorbing talk given on Dec. 17 by Bruce LaFollette, chief assayer of the U. S. Mint at Denver, and treasurer of the local chapter. The kodachrome slides illustrating the talk were the first ever made and were taken by Mr. LaFollette personally.

Mr. LaFollette's talk was divided into two principal parts. First, he dealt with the carefully controlled refining processes by which crude bullion received from mines, mills and smelters, and industrial scrap, are converted into fine gold and silver. Second, he described in detail the processes by which the constituent metals in coin are made into the finished article.

Uniform Composition Essential

Outstanding impressions gained from the talk were the extreme care needed to get the required uniformity of composition, the precaution which must be taken to recover possible losses of metal, and the variety of precious metals other than gold and silver which are by-products of refining.

In the discussion of assay control it was brought out that careful organization, using special methods, permits the making of many hundreds of very accurate assays in a day by a relatively small but efficient analytical staff. Refining is electrolytic, with specific techniques for various grades of crude bullion, and with gold and silver products in excess of 99.9% purity.

Weight Tolerances Close

The description of the coin making processes was impressive from the standpoint of the extreme care and special devices that are used to keep the finished coin within the very close weight tolerance allowed by law. Automatic scales remove coin blanks that are outside the weight tolerance. The heavy condemned blanks are brought to proper weight in a machine which shaves off a slight amount of metal from each blank.

The finished coins are reviewed on a slowly moving belt and defective ones removed, after which they are counted, sacked and stored in the mint shipping vaults. Distribution to general circulation is made through the Federal Reserve banks.

The evening's program started with a cocktail party before the usual dinner. Just before the feature talk, John Holtman was presented with a Past Chairman's Plaque by Ray McBrian, the first chairman.

—V—

Grossmann's Talk Characterized by Directness, Clarity

Reported by A. S. Coffinberry
University of Notre Dame

Notre Dame Chapter is not among those that have enjoyed the luxury of a series of educational lectures on heat treating. However, the major benefits to be derived from such a course were to a large extent realized through a single address presented on the occasion of National Officers' Night, Jan. 12.

The compression of the broad subject, "Principles of Heat Treatment", into one lecture without loss of effectiveness in presentation probably could not have been so successfully accomplished by anyone other than President M. A. Grossmann, who gave the talk.

Fe-C Diagram Interpreted

Conforming to the appealingly practical approach he employs in his book of the same title, Dr. Grossmann interpreted the iron-carbon diagram and other fundamental concepts underlying heat treating practice with the directness and clarity which characterize that classic contribution to metallurgical literature. Despite the need for conciseness, he was able to go well beyond the content of his book in reporting recent additions to heat treating knowledge, particularly in the field of alloy steels.

Tempering Problems Answered

The discussion period following his lecture enabled industrial heat treaters present to obtain opinions regarding their pet problems. These pertained to such questions as the effect of alloy content on the brittle range in tempering, and ultimate grain size attained after long times at high temperatures.

John Grodrian introduced an interesting point with a question on the possibility of obtaining higher hardness values by tempering first at a lower and then a higher temperature rather than by drawing at the higher temperature only.

Preceding Dr. Grossmann's talk the enthusiastically anticipated report of Secretary W. H. Eisenman on the Society's activities was heard. Mr. Eisenman did not disappoint his hearers, who have learned to look forward from year to year to the entertainment afforded by his remarks.

—V—

Purdue Students Hear Van Horn at Muncie

Reported by J. D. McNair
Indiana Steel and Wire Co.

Muncie Chapter—The November meeting, held at the Hotel Roberts, drew 60 men to the dinner and about 100 to hear the excellent lecture by Kent R. Van Horn, national A.S.M. vice-president, on "Aluminum and Its Alloys". National Secretary Eisenman gave an agricultural report that was received with great enthusiasm.

Among those attending the lecture were a group of metallurgy students from the Purdue ESMWT class, taught by John Tate, a member of the chapter.

Past Chapter Chairman's Certificates were presented to Louis W. Murray, Roy M. Atwater, and Alvin W. Holmes.

—V—

Steel trade journals in 1893 contained much news of tests made of the recently developed heat treated armor. In one test, conducted at St. Petersburg, capital of czarist Russia, American-made armor proved superior to competitive armor made in England and France, and was finally specified for use on Russian battleships.

Bureau of Mines Has New Film on Nickel

Portraying the spectacular production story of nickel from the time crude matte arrives at the refining plant until mirror-finish sheets and other products leave, a new Bureau of Mines educational film entitled "Nickel and Nickel Alloys" now is available for free public distribution, Dr. R. R. Sayers, director of the Bureau, has announced.

Applications for free short-term loans of "Nickel and Nickel Alloys" should be addressed to the Graphic Services Section, Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa., and should state specifically that the borrower has a sound projector for 16-millimeter film, the agency advised. Although no charge is made for use of the film, the exhibitor is expected to pay transportation charges both ways and for loss or damage other than normal wear.

Logic of Quenching Summed up

—Shepherd

Reported by H. P. Henderson
Prod. Eng., New Departure Div., G.M.C.

Hartford Chapter—B. F. Shepherd, chief metallurgist for the Ingersoll Rand Co., and a past national president of the A.S.M. who has won the Sauveur Achievement Award for work on tool steels, was the speaker for the January meeting. Introduced by A. H. d'Arcambal, vice-president of Pratt & Whitney Division, Mr. Shepherd spoke on "Martempering".

Mr. Shepherd does not believe that the new alloy steels resulting from war metallurgy have been reduced to the cook-book stage. He does feel, however, that more scientific papers and technical data must be applied by practical men.

Martempering Not New

"Martempering", Mr. Shepherd stated is not a new idea. Quenching is done in molten salt baths above the point at which martensite forms and the work then cooled in air; the cooling rate in the salt is faster than the critical rate.

Quenching practice has a great influence on end results since quenching is an attempt to control the cooling rate to obtain a structure. Mr. Shepherd felt that most data are based on laboratory practice, while in the shop the human element has to be considered since shop interest centers on reproduction in quantity and uniformity.

The speaker summed up the logic of quenching as follows:

A slower quench speed requires greater hardenability.

The cheapest and most important alloy to provide hardenability is carbon.

Cooling rate means the rate obtained in any way by any method.

As the cooling rate drops off, other alloys than carbon enable us to maintain hardness.

With the old alloy steels there was not much difference in hardenability range of any particular specification.

With the new lower alloy steels small differences affect the hardenability greatly.

Select Steel for Least Strain

Quenching practice, therefore, must be based on the lowest hardenability, and both quenching practice and steel must be chosen for the least residual strain. The best procedure on any part would be to start with the part, decide on the quench, and then pick out the steel.

Mr. Shepherd stated that "Martempering" is a recognition of the mechanism of the hardening procedure where the part can be held in the bath above the point where martensite forms until the temperature is equalized throughout, provided the cooling rate exceeds the critical rate.

The speaker recommended the Jominy test for hardenability and showed slides of large salt bath quenching installations, some even having motor driven agitators.

—V—

Menu for Officers' Night

(Continued from page 1)

and digestible. The precision, clarity and logic of President Grossmann's favorite subject was evident to all, the general reaction being keen satisfaction with the portions dished out.

The dining hall was filled to capacity and represented the entire metal industry of the St. Louis district—operations, sales, research and management. Individual tables were arranged for companies and their guests, and a live, congenial atmosphere prevailed.

After the general meeting additional refreshments were served, with many lively sessions. A large number of the guests and members stayed to "put out the lights".

Oil Composition Affects Speed Of Quenching

—Carmichael

Reported by A. Floyd Whalen
Chief Metallurgist, Harrisburg Steel Corp.

York Chapter—E. S. Carmichael of the Technical Service Division of Socony-Vacuum Oil Co., Inc., New York office, addressed the chapter on Dec. 15 on the subject of "Quenching Oils". Particular attention was given to the effect of oil composition on the rate of quench.

It was shown, for example, that for certain quenching operations, marked differences exist in oils with respect to quenching speed. For other operations, where the carbon content of the metal is high or the size of the piece is small, the rate of quench may be practically the same for all oils.

It was pointed out by Mr. Carmichael that one of the principal reasons for different cooling rates in the case of petroleum hydrocarbons was the formation of a vapor blanket around the metal part, which he designated as the "A" stage. In some cases, this blanket persists for a relatively long time, which results in slow cooling through the critical range.

In other cases, cracking may set up turbulence at the metal-oil interface, which disrupts the vapor blanket, and produces relatively fast cooling.

Attention was also given to the "B" and "C" stages during a quenching operation. It was pointed out that the wetting characteristics of the oil were important, but not so much as generally believed.

The importance of low volatility and good stability against oxidation, thermal decomposition and polymerization were stressed. The reactivity of the hydrocarbons from the various types of crudes was discussed at some length as well as the relation of chemical structure to rate of quench.

—V—

STILL USEFUL even in the face of reduced stocks of things to sell, advertising must hold its place among the activities of the wise business man, believes Prof. F. A. Russell of the University of Illinois College of Commerce.

There will be a buyer's market after the war, he suggests, in place of the present seller's market, and the business which has dropped out of the buyer's consciousness and lost touch with its customers will be heavily handicapped.

—V—

Avoid a "Blackout" of your business. Advertise it in METAL PROGRESS.

M.S.M. Group Honors Seniors

Missouri School of Mines Group held a strictly social meeting on Jan. 13 that was devoted to a steak dinner honoring the senior metallurgists who were to leave for the Services and industry. The seniors are as follows:

William T. Rule, Eagle-Picher Mining and Smelting Co., Galena, Kansas.

Warren L. Larson, Aluminum Co. of America.

James D. Dowd, Aluminum Co. of America, New Kensington, Pa.

Alfred Dick, Columbia Steel Co., Pittsburg, Calif.

Louis A. Hartcorn, U. S. Navy.

Ed. C. Goetemann, National Bearing Metals Corp., St. Louis, Mo.

Robert Denison, Sheffield Steel Co. of Texas, Houston, Texas.

Edward P. Patterson, Pratt & Whitney Aircraft Corp.

R. Mateer, Western Electric Co., Kearny, N. J.

Roger H. Heidenreich, U. S. Navy.

Alan J. Fuchs, Columbia Steel Co., Pittsburg, Calif.

Cpl. Donald W. Frommer, U. S. Army.

Vernon Pingel, Curtiss Wright Corp., Buffalo, N. Y.

Sanford L. Simons, Battelle Memorial Institute, Columbus, Ohio.

Bob Westwater, U. S. Navy.

Edward Schultz, Columbia Steel Co., Torrance, Calif.

Welded Ships Is Subject Of Joint Meeting With ASM

(Continued from page 1)

drawback in using a combination of welding and riveting.

Shipyards, as well as all other engineering and production organizations contributing to the shipbuilding program, are working far beyond their normal capacity under very trying conditions in this "war of tonnage". These abnormal conditions are the cause of most of the difficulties encountered.

A sense of appreciation on the part of management is very necessary for controlling welding and other production operations, such as fabrication and fitting, which have an important influence upon the welding operations. Although in many yards and plants a weakness in supervision is prevalent due to lack of training, added supervisor training courses are helping this situation.

Mr. Grover emphasized that without welding and gas cutting the tremendous program of shipbuilding would have been impossible. The percentage of ships in which serious difficulties have occurred is actually very small.

Mr. Grover showed by means of slides that usually a combination of several unfavorable circumstances, involving design details and materials as well as workmanship, causes cracks and failures in welded structures. Severe conditions in one or two respects alone, however, may cause failure.

Recommendations were made to overcome these pitfalls in welded fabrication and the need for good workmanship was stressed.

Liberal sniping of stiffeners, webs and brackets, avoids concentration of welding and constraint against ductile behavior. Run-off bars at ends of butt welded joints in girder flanges, and at plate edges, insure sound welds at edges.

The use of preheating to provide shrinkage in one part that will balance weld shrinkage in another part was another suggestion offered by the speaker but he warned about the effect upon shrinkage stresses of injudicious location of preheat.

Moving the location of a joint to reduce restraint and concentration of weld shrinkages, use of members with serrated edges to overcome objections to intermittent welding, accurate control and guiding of manual cutting operations were other recommendations.

Mr. Grover's closing remarks were well chosen: "When one considers the tremendous volume of welded shipbuilding, the amount of trouble that has been experienced is relatively small. However, it is the duty of everyone engaged in the program to see that his part is done conscientiously."

Review of Current Metal Literature—(*Continued*)

11. LABORATORY APPARATUS

(*Continued from page 3*)

9. Normal Sections of Fine Wire. R. G. Sartorius. *Metal Progress*, v. 45, no. 1, Jan. '44, p. 90.
Method for mounting 0.00445-in. resistance wire for microscopic examination of roundness.

10. Electronics—an Important Aid in the Processing of Steel. Carl J. Madsen. *Steel Processing*, v. 30, no. 1, Jan. '44, pp. 25-28.
Developments of electronics explained by breaking down the application into nine classifications: Rectification, inversion, high frequency heating, communications, measurements, control, inspection and sorting, precipitation, radiation.

11. Electron Tube—Genie, Gremlin, or Jeep? W. D. Cockrell. *Industry & Welding*, v. 17, no. 1, Jan. '44, pp. 60, 62, 73-80.
Types of electron tubes and their uses.

12. Accuracy and the Geometry of Precision. E. Willard Pennington. *Tool & Die Journal*, v. 9, no. 10, Jan. '44, pp. 99-101.
Precision, workmanship, methods and tools.

13. Electron Diffraction. G. P. Thompson. *Canadian Metals & Metallurgical Industries*, v. 7, no. 1, Jan. '44, pp. 25-27.
Particularly applicable to study of polished layer on metals, lubrication of metals, and formation of crystals and compounds.

12. TESTING, INSPECTION AND RADIOGRAPHY

1. Operating Temperatures and Stresses of Aluminum Aircraft Engine Parts. E. J. Willis and R. G. Anderson. *S.A.E. Journal*, v. 52, no. 1, Jan. '44, pp. 28-36.
To study fatigue stresses, a hydraulically operated fatigue testing machine is used which can produce up to 100,000 lb. of load in either or both directions between the master piston and the bolster plate at 1300 cycles per min. Electric heaters, properly controlled, simulate operating temperatures of the piston.

2. Dynamic Hardness Testing at Elevated Temperatures. Erich Fetz. *Iron Age*, v. 152, no. 27, Dec. 30, '43, pp. 40-52.
Dynamic hardness at elevated temperatures of alloys in comparison with high speed steel and Stellite; hot hardness of low and high-alloy nickel-chromium steels, Stellite and Stellite substitute alloys with lower strategic metal content; dynamic hardness of brass, bronze and copper-aluminum with rising temperatures.

3. Fatigue—the Forgotten Member of the Design Family. H. O. Boyvey. *Aero Digest*, v. 44, no. 1, Jan. '44, pp. 74-76, 126-128, 133-136.
Static tests are insufficient as parts so tested frequently fail in service through fatigue; responsibility for and theory of failure, proper limit loads, plotting stress failure, rotary tension fatigue machine.

4. An Engineering Approach to the Selection, Evaluation and Specification of Metallic Materials. H. W. Gillett. *Steel*, v. 114, no. 4, Jan. 4, '44, pp. 80, 82, 85-86, 88, 90.
Testing metals used for high temperature service presents problems not otherwise encountered where service conditions are less severe. Factors involved and conventional tests.

5. Introduction to the Theory of Photo-Elasticity and Its Application to Problems of Stress Analysis. R. E. Arthur. *Engineers' Digest*, v. 1, no. 1, Dec. '43, pp. 27-30.
Nicol prism, the propagation of light in a crystal.

6. Distortion of Radiographic Image. Robert Taylor. *Automotive & Aviation Industries*, v. 90, no. 2, Jan. 15, '44, pp. 34-35.
Conditions set forth to produce sharp true shadow of a defect. Forms of distortion discussed. 3 ref.

7. Screw Threads. S. M. Arnold. *Automobile Engineer*, v. 33, no. 444, Dec. '43, pp. 541-546.
A review of the literature dealing with fatigue effects.

8. The Weakening Effect of Strengthening Ribs. A. Fisher. *Magnesium Review*, v. III, no. 4, July '43, pp. 93-97.
Stress concentration. Criterion for strength of casting.

9. Maintaining Quality Control of Machined Parts. Louis C. Young and A. L. Atherton. *Machinery*, v. 50, no. 5, Jan. '44, pp. 167-172.
How a system of statistical quality control is being used in connection with the inspection of machined parts at the Westinghouse East Springfield, Mass., plant.

10. Screening Materials for Use in Industrial Radiography. G. H. S. Price. *Metal Industry*, v. 63, no. 22, Nov. 26, '43, pp. 338-339.
Description of screening materials, particularly heavy alloys, for use in industrial radiography. 6 ref.

11. Estimating Radiographic Exposures for Multi-Thickness Specimens. H. E. Seeman and George M. Corney. *Industrial Radiography*, v. 11, no. 2, Fall '43, pp. 33-38.
Exposure chart, curve of X-ray film exposure determination. 10 ref.

12. Improved Stereoscopic Radiography. Benjamin B. Burbank. *Industrial Radiography*, v. 11, no. 2, Fall '43, pp. 20-23, 31-32.
Basic principles of a method for accurate, three-dimensional location of depth of defects by using a reference marker, a fixed grid and two films separately exposed.

13. Testing with X-Ray Counting Tubes. *Industrial Radiography*, v. 11, no. 2, Fall '43, pp. 39-41.
An outline of recent German developments in quantitative intensity measurements by Geiger-Mueller counting tubes for use in detecting corrosion, blow holes and inclusions. (Reprinted from *Iron Age*, June 10, 1943.)

14. Radiographic Density Measurement. D. M. McCutcheon and Jonathan Parsons. *Industrial Radiography*, v. 11, no. 2, Fall '43, pp. 13-14.
Method of density determination to measure densities less than 2.5.

15. Recent Developments in X-Ray Inspection. Kent R. Van Horn. *Metal Progress*, v. 45, no. 1, Jan. '44, pp. 78-82.
Survey of X-ray equipment, accessories, and applications of radiography.

16. Microradiography of Alloys. Robert C. Woods and V. C. Cetrone. *Metals and Alloys*, v. 18, no. 6, Dec. '43, pp. 1320-1325.
Uses for determining internal structure; technique; advantages of the single (W-target) X-ray tube. 6 ref.

17. Early Detection of Fatigue Cracks. G. B. Kiner. *Metal Progress*, v. 45, no. 1, Jan. '44, p. 89.
Use of soap solution to detect minute cracks.

18. A Method of Predicting Life of Tractor Bearings. John Borland. *S.A.E. Journal (Transactions)*, v. 52, no. 1, Jan. '44, pp. 19-27.
Rating bearings on a fatigue basis is, according to tests carried out by Mr. Borland, a reasonably accurate way of predicting bearing life when loading conditions are definitely established.

19. Correlation of the Strength and Structure of Spot Welds in Aluminum Alloys. F. Keller and D. W. Smith. *Welding Journal*, v. 23, no. 1, Jan. '44, pp. 23s-26s.
Radiographic method of testing strength of spot welds. 3 ref.

20. Fatigue Strength of Welded Aircraft Joints. T. V. Buckwalter and O. J. Horger. *Welding Journal*, v. 23, no. 1, Jan. '44, pp. 50s-58s.
Methods and results of fatigue tests on welded steel aircraft tubing. 4 ref.

21. Fatigue Studies of Weld Test Triangular Structures with NE8630 Steel Tubing. A. J. Williamson. *Welding Journal*, v. 23, no. 1, Jan. '44, pp. 27s-32s, 49s.
Sufficient points in fatigue testing were established and indicated little difference in the fatigue value for as-welded, tempered after welding, and normalized after welding test triangles. Some correlation between welding defects such as blisters, burning through, craters, etc. Failure could not be attributed directly to the high hardness in the heat-affected zone.

22. Modern Hardness Testing Machines. Von Dipl.-Ing. Kurt Meyer. *Engineers' Digest*, v. 1, no. 2, Jan. '44, pp. 102-104.
Rockwell "Testor", "Welltest", "Orthotest", the Super-Rockwell surface hardness machine, Briro UVK hardness tester described. Also instruments for internal Rockwell hardness measurements.

23. Cracks in Wheel Seats Within the Hubs of Wheels. G. W. C. Hirst. *Engineering*, v. 156, no. 4067, Dec. 24, '43, pp. 501-502.
Mathematical examination of the development of fatigue cracks in axles or shafts to which a wheel or other component is fixed by pressing or shrink fitting.

24. The Technique of Microradiography. S. E. Maddigan. *Journal of Applied Physics*, v. 15, no. 1, Jan. '44, pp. 43-54.
Investigations have been made of the various factors considered to influence the sensitivity of the microradiographic method for the examination of alloys. Both target element and applied voltage influenced the results. Radiographs are shown to demonstrate the effect; an explanation is given in terms of the X-ray emission curves and the absorption differential curves for the phases of the radiographed alloy. 7 ref.

25. An Engineering Approach to the Selection, Evaluation and Specification of Metallic Materials. H. W. Gillett. *Steel*, v. 114, no. 5, Jan. 31, '44, pp. 83-88, 102-110.
Testing of parts under simulated service conditions and machinability as a processing requirement in selecting materials. Chemical composition alone is not a sufficient criterion in evaluating materials.

26. Special-Purpose X-Ray Equipment. *Aircraft Production*, v. 6, no. 63, Jan. '44, pp. 42-43.
Quantity-production inspection of aircraft bearings and light alloy castings.

27. Alteration of X-Ray Beams to Meet Inspection Requirements. Robert Taylor. *Aero Digest*, v. 44, no. 2, Jan. 15, '44, pp. 114, 116, 206, 209.
The use of filters to alter the quality of a beam of X-rays is an empirical practice. The means by which the X-ray beam may be altered to meet individual requirements for inspection is discussed.

28. The Possibility of Exploiting Magnetic Phenomena in the Testing of Steel. Tadeusz W. Wlodek. *Canadian Mining & Metallurgical Bulletin*, no. 381, Jan. '44, pp. 5-15 (Trans.).
That a test piece of ferro-magnetic steel is magnetic after it has been broken in tension indicates that, while it is being loaded, the steel acquires magnetic properties. In the present investigation of the influence of the stress on the magnetic flux, repeated pulsating stresses of increasing amplitude, varying from zero to the maximum tensile value, i.e., pull-pull loading, were employed. The specimens were prepared from two types of carbon steel and two of alloy steel. The magnitude of the magnetic flux was determined indirectly.

29. Effect of Strain Rate Upon Plastic Flow of Steel. C. Zener and J. H. Hollomon. *Journal of Applied Physics*, v. 15, no. 1, Jan. '44, pp. 22-32.
An experiment has been designed to check a previously proposed equivalence of the effects of changes in strain rate and in temperature upon the stress-strain relation in metals. It is found that this equivalence is valid for the typical steels investigated. The behavior of these steels at very high rates of deformation may, therefore, be obtained by tests at moderate rates of deformation performed at low temperatures. The results of such tests are described. 13 ref.

30. Practical Application of Quality Control. W. A. Bennett and J. W. Rodgers. *Machinery (London)*, v. 63, no. 1628, Dec. 23, '43, pp. 701-706.
Production has been materially assisted in a factory making small metal components to close engineering tolerances on single and multi-spindle automatic machines, by the introduction of quality control.

31. Studies in Three-Dimensional Photo-Elasticity Stress Concentrations in Shafts With Transverse Circular Holes in Tension. Relation Between Two-and Three-Dimensional Factors. Max M. Frocht. *Journal of Applied Physics*, v. 15, no. 1, Jan. '44, pp. 72-78.
Part I. General problems of technique arising in three-dimensional photo-elastic analysis by means of the frozen stress pattern method are discussed. These include suggestions for loading, slicing, improvements of boundary visibility, a discussion of time stresses, and methods for the determination of the fringe order and fringe value in a model with a static or frozen stress pattern. Part II. Stress concentration factors for shafts. 7 ref.

13. TEMPERATURE MEASUREMENT AND CONTROL (PYROMETRY)

1. Constant Heating Rate Control. R. J. Smith. *Metal Industry*, v. 63, no. 26, Dec. '43, pp. 402-404.
Control of heating and cooling rate based upon the combined principles of the rectifier ammeter (for anticipation of power change) and the thermocouple (for initiating power equipment to produce temperature change). Either millivoltmeter or potentiometric equipment may be used to control power-controlling equipment such as resistors or auto-transformers.

2. Spherical Furnace Calorimeter for Direct Measurement of Specific Heat and Thermal Conductivity. *Industrial Heating*, v. 11, no. 1, Jan. '44, p. 126.
Thermal conductivity is measured by determining the inner and outer sample temperature at steady heat flow; specific heat is measured by noting temperature rise of sample with a known heat input while maintaining the calorimeter shells near the adiabatic condition.

14. FOUNDRY PRACTICE AND APPLIANCES

1. The Future of Magnesium Castings. D. Basch. *Foundry*, v. 72, no. 1, Jan. '44, pp. 116, 199-202.
Advantages of Mg castings: Light weight, excellent machinability, damping characteristics, high fatigue strength, non-sparking, non-magnetic. Disadvantages: Modulus of elasticity lower than Al; if stiffness is needed, Mg must be 17% thicker in sections.

2. Casting Manganese Bronze. John S. Roberts. *Foundry*, v. 72, no. 1, Jan. '44, pp. 100-101, 158-159.
To attain desired physical properties in Mn bronze castings tensile strength in the ingot should be specified 5000-10000 psi. higher than the minimum required in the casting. Elongation in the ingot should also be higher. Melting and casting and fuel requirements given.

3. Tests Graphite Rods in Producing Cast Steel. F. J. Vosburgh and H. L. Larson. *Foundry*, v. 72, no. 1, Jan. '44, pp. 108-111, 194.
Carbon vs. graphite rods used to reduce metal loss in risers of steel castings.

4. Steel Castings. Edwin Bremer. *Foundry*, v. 72, no. 1, Jan. '44, pp. 104-105, 184-185.
Furnace details, power requirements, metal charge, slag samples. (To be cont.)

5. Increases Corebox Life. Horace L. Dudley. *Foundry*, v. 72, no. 1, Jan. '44, pp. 103, 169-171.
Design data.

6. Duplexing in Malleable Iron Production. Donald J. Reese. *Foundry*, v. 72, no. 1, Jan. '44, pp. 98-99.
In the past 15 years production of Blackheart malleable iron has been changing from air furnaces (reverberatory) to continuous melting with duplex system.

7. New Gray Iron Foundry Makes Machine Tool Castings. William G. Gude. *Foundry*, v. 72, no. 1, Jan. '44, pp. 112-115, 195-198.
Plant layout.

8. Foundry Industry Makes Progress in Practice and Product. *Foundry*, v. 72, no. 1, Jan. '44, pp. 106-107, 186.
1944 forecast for bronze castings, advances in steel casting and gray iron industry, boron in malleable, future specifications to be more exact, manpower shortage cuts non-ferrous output.

9. Metallurgical Factors of Importance to the Practical Aluminium Founder. S. A. E. Wells. *Foundry Trade Journal*, v. 71, no. 1422, Nov. 18, '43, pp. 225-228.
(Discussion) on repeated melting of Alpax Gamma with and without flux additions, loss of Mg, burning of Al, Zn content and grain size.

10. Metallurgical Factors in Importance to the Practical Aluminium Founder. S. A. E. Wells. *Foundry Trade Journal*, v. 71, no. 1420, Nov. 4, '43, pp. 179-184.
Grain refining; influence of Al on grain. Gases—occurrence, causes aand removal; elimination of pinholes; loss of Mg.

11. The Production of Bronze Castings for the Merlin Engine. John Allan. *Foundry Trade Journal*, v. 71, no. 1424, Dec. 2, '43, pp. 261-266, 273.
Si bronze, gravity die-casting, exhaust valve guides, Al bronze.

12. Production of Truncated Pistons. A. H. Climas. *Foundry Trade Journal*, v. 71, no. 1423, Nov. 25, '43, pp. 245-247.
Description of molding and coring practice.

13. High-Grade Cast Iron from Low Pig-Iron Cupola Charges. J. E. Rehder. *Foundry Trade Journal*, v. 71, no. 1424, Dec. 2, '43, pp. 267-272.
Cupola charge composition, pig-iron, remelt and borings, coke, cupola operation, and inoculation practice.

14. Blackheart and Pearlitic Malleable Cast Irons. Bureau of Mines Report. *Foundry Trade Journal*, v. 71, no. 1423, Nov. 25, '43, pp. 239-244.
Composition, properties, and uses of Blackheart malleable iron; pearlitic malleable iron, Promal, Arma-Steel, and Z-Metal.

15. Notes on Oil-Sand Practice in the Ordinary Foundry. Wm. Y. Buchanan. *Foundry Trade Journal*, v. 71, no. 1425, Dec. 9, '43, pp. 291-294.
Type of sand used, grain size, making binders in the foundry, storage and drying.

16. Copper Alloy Castings. H. J. Miller. *Canadian Metals & Metallurgical Industries*, v. 6, no. 12, Dec. '43, pp. 33-36.
Wartime changes in metals, foundry practice and applications in Britain.

17. Carbon Control of Cupola Cast Iron. H. Kenneth Briggs. *Canadian Metals & Metallurgical Industries*, v. 6, no. 12, Dec. '43, pp. 27-32.
Factors affecting graphitization; coke as a source of carbon; steel, a diluent of carbon; supersaturated irons; melting high strength irons. 8 ref.

Review of Current Metal Literature—(*Continued*)

18. **Future of Magnesium Castings.** D. Basch. *Iron Age,* v. 153, no. 2, Jan. 13, '44, pp. 54-57.
Evaluates the properties of magnesium for sand, die and centrifugal casting; suggests future improvements.

19. **Some Malleable Iron Castings Problems.** *Iron Age,* v. 153, no. 3, Jan. 20, '44, pp. 68-69.
The gating of castings, preservation of chills, and use of synthetic sands.

20. **Mass Production Casting of Bombs.** *Iron Age,* v. 153, no. 2, Jan. 13, '44, pp. 64-66, 134.
Casting of 500-lb. bombs with maximum steel scrap and minimum ferro-silicon.

21. **Zinc Die-Casting Alloys.** S. W. K. Morgan and B. D. Darrah. *Metal Industry,* v. 63, no. 23, Dec. 3, '43, pp. 354-356.
Mechanical properties at subnormal temperatures, comparison of physical properties, theoretical considerations, X-ray examination. 8 ref.

22. **Moulding Large Bronze Propellers.** *Metal Industry,* v. 63, no. 25, Dec. 17, '43, pp. 389-391.
Foundation plates, rigid mould, ramming the cope, and cores.

23. **Machines for Die-Casting.** *Aircraft Production,* v. 5, no. 62, Dec. '43, pp. 599-600.
New low-temperature, high-pressure equipment.

24. **Continuous Pouring of Magnesium Engine Castings.** *Aviation,* v. 43, no. 1, Jan. '44, pp. 150-159.
How Chevrolet converted its iron foundry to make magnesium engine castings.

25. **A Method of Correlating Foundry Practice and Quality of Light Alloy Castings.** H. G. Warrington. *Engineers' Digest,* v. 1, no. 1, Dec. '43, pp. 45-49.
Methods of production of aeroplane casting to keep loss at a minimum.

26. **Why Die Casting?** *Die Casting,* v. 1, no. 2, Dec. '43, pp. 18-20.
Machining and finishing.

27. **Why Die Casting?** *Die Casting,* v. 2, no. 1, Jan. '44, pp. 32, 34.
Advantages are casting speed and high production rate. Comparison to sand casting and stamping.

28. **Tooling for Tools.** F. J. Koenig and H. F. Linder. *Die Casting,* v. 2, no. 1, Jan. '44, pp. 35-36.
Smooth surface finish, clean lines and sharp detail of die castings are important factors in their success.

29. **Economy in a Housing.** *Die Casting,* v. 2, no. 1, Jan. '44, pp. 18, 20.
Designers familiar with the possibilities of die castings and the way they can simplify manufacture are making them count in achieving minimum costs without any offsetting disadvantage and often with gains other than those of economy in cost.

30. **Aircraft Magnetos.** Walter K. Dow. *Die Casting,* v. 2, no. 1, Jan. '44, pp. 28-32.
Development of die casting due to (1) advantages to use and consumer (2) molded plastics competition with die castings (3) advantages to producer of die castings.

31. **Copper Rings Centrifugally Cast.** *Western Metals,* Jan. '44, p. 12.
Method of casting copper rings centrifugally used at General Electric's Schenectady works.

32. **Trends in Iron Foundry Metallurgy.** J. S. Vanick. *Metal Progress,* v. 45, no. 1, Jan. '44, pp. 83-85.
Hot blast systems, humidifying installations, duplex melting, inoculation and heat treatment of cast iron.

33. **Precision Casting.** *Steel,* v. 114, no. 2, Jan. 10, '44, pp. 78-82, 96.
New production tool used on parts weighing 5-7 lb. with high strength factors and close dimensional limits.

34. **The Use of Intensifiers in Iron Castings.** Fred C. T. Daniels. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 94-95.
The effect of the use of various intensifiers in iron castings, particularly the use of boron.

35. **Mass Production Casting of Bombs.** *Iron Age,* v. 153, no. 2, Jan. 13, '43, pp. 64-66, 134.
The casting of 500-lb. bombs with maximum steel scrap and minimum ferro-silicon. Particularly interesting is the fact that the foundry uses a satisfactorily-working, well synchronized triplex method.

36. **Control of Cast Iron.** Whiting Lathrop. *Canadian Metals & Metallurgical Industries,* v. 7, no. 1, Jan. '44, pp. 12-16.
Making better castings in the smaller foundry. Raw materials, steel scrap, cast iron scrap, ferro-alloys, pig iron. Quality control.

37. **Quality of Castings Begins in the Foundry.** William G. Reichert. *Foundry Trade Journal,* v. 71, no. 1427, Dec. 23, '43, pp. 323-328.

38. **The Halifax Undercarriage Bridge Casting.** J. A. Oates. *Aircraft Production,* v. 6, no. 63, Jan. '44, pp. 21-31.
Foundry production methods; machining sequence; extensive use of horizontal boring machines tooled for quantity production work.

15. SECONDARY METALS

1. **Winning the War with Scrap.** *Aviation,* v. 43, no. 1, Jan. '44, pp. 184-185.
Everything except dust on the floors is saved by NAA's Texas Division. Dividend paying salvage program.

2. **Length of War in Europe Will Probably Affect Supply of Scrap.** Edwin C. Barringer. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 65-67.
Figures on consumption of iron and steel scrap to show probable effect of length of war on available supply.

3. **The Navy's Salvage Program.** F. Lowell Lawrance. *Mining and Metallurgy,* v. 25, no. 445, Jan. '44, pp. 12-13.
Various kinds of scrap segregated and re-used, or sold by sealed bids or auction.

16. FURNACES AND FUELS

1. **Heat Generating Pads.** *Metal Industry,* v. 63, no. 21, Nov. 19, '43, pp. 329-330.
Ways in which heat generating pads of the types described may find useful application in industry, since with them a controlled temperature-time cycle can be obtained without the use of mechanical connections.

2. **Fixtures Boost Pit Furnace Capacity.** Joseph Sammon. *American Machinist,* v. 88, no. 1, Jan. 6, '44, pp. 88-90.
Maximum efficiency is realized from pit-type furnaces when the work supporting means is designed with an eye upon the nature of the parts, the heat-treating process and the quality standards involved.

3. **Developing an Induction Heating Machine.** William Tuerck, Jr. *Machine Design,* v. 16, no. 1, Jan. '44, pp. 137-139, 194.
Spark-gap high-frequency induction oscillator, design and operation: types of gaps, brazing of disks.

4. **Bright Annealing of Steel Strip in Electrically Heated Bell-Type Furnace in Russian Steel Mill.** V. A. Sochinski and V. P. Gryaznov. *Engineers' Digest,* v. 1, no. 1, Dec. '43, pp. 58-59.
Description of PSK-210 furnace.

5. **Anthracite Pig Iron.** R. H. Sweetser. *Iron Age,* v. 152, no. 27, Dec. 30, '43, pp. 32-39.
History of anthracite as a metallurgical fuel.

6. **Steel Mill Boiler Units Use Supplementary Fuels.** M. H. Kuhner. *Steel,* v. 114, no. 4, Jan. 24, '44, pp. 62-64, 66.
Quick-cleaning burners for blast furnace gas, and a recently designed unit for handling 4 types of fuel either independently or in combination. Summary of the successful performance of steel mill boilers fired with blast furnace gas.

7. **Steel Mill Boiler Units Use Supplementary Fuels.** M. H. Kuhner. *Steel,* v. 114, no. 3, Jan. 17, '44, pp. 96-100, 123.
High-capacity steam generating plants firing blast furnace gas in combination with pulverized coal are designed with low rate of heat release. Super-heater performance affected by mass gas flow. Correct fuel-air ratio and combustion control.

8. **Steam Generation in Steel Plants.** F. X. Gilg. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 128-133, 158.
Various designs for boilers for use in steel mills showing modern improvements in boiler circulation, feed-water treatment and fuel and furnace requirements for reliable steam generation.

9. **Electric Furnace Practice.** W. J. Reagan. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 89-93.
Method of electric furnace steel production with discussion of the charge, and melting down, and finishing slag. Tables and charts.

10. **The Expansion Program and the Future of the New Blast-Furnaces.** Wm. A. Haven. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 113, 158.
Post war use of the new blast furnaces.

11. **The Dimensions and Rating of the Blast Furnace.** Owen R. Rice. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 114-118.
Method for measuring and rating a blast furnace.

12. **Effect of Good and Bad Coke on Blast Furnace Operation.** Charles J. Rice. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 101-103.
Types of coke and the results of their use in blast furnaces.

13. **Selection of Electric Furnace Types.** Victor Paschkis. *Industrial Heating,* v. 11, no. 1, Jan. '44, pp. 52, 54, 56, 58, 60.
Considerations in selection of a type of electric furnace and relative merits of each type.

14. **New Electric Furnace Steel Making Plant Has 160,000 Tons Capacity.** 11. *Industrial Heating,* v. 11, no. 1, Jan. '44, pp. 70, 72, 74, 76.
Plant layout, furnace design. Flow of materials through the plant, making a typical heat, tapping a heat, ladle design, teeming practice and production scheduling and control.

15. **Emergency Conversion of Industrial Furnaces from Gas or Oil to Coal.** W. Trinks. *Industrial Heating,* v. 11, no. 1, Jan. '44, pp. 46, 48, 50.
Factors involved in reverting to use of coal, burned on a grate, as fuel for heating furnaces.

16. **Colloidal Oil as a War and Post-War Fuel.** J. G. Coutant. *Iron & Steel Engineer,* v. 21, no. 1, Jan. '44, pp. 58-64.
A mixture of 40% pulverized coal, 60% fuel oil is advocated by the author as a means of reducing oil consumption. No change in equipment for handling and burning is said to be necessary.

17. **Progress in Supplying Power to Arc Furnaces.** C. C. Levy. *Iron & Steel Engineer,* v. 21, no. 1, Jan. '44, pp. 36-42.
Furnace design and skillful operation have combined with progress in electrical equipment and power supply to give electric arc furnaces an excellent production record.

18. **The History of the Small Steelmaking Converter.** E. C. Pigott. *Engineering,* v. 71, no. 4067, Dec. 24, '43, p. 515.
Development of converter from 1856-1896. (Part I).

17. REFRACTORIES AND FURNACE MATERIALS

1. **Refractory Realization in 1943.** Adrian G. Allison. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 85-88.
Discussion of types of refractories, their various uses, and the probability of their adequate supply.

2. **Steel Plant Refractories Problems.** Louis A. Smith. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 104-108.
Discussion of blast furnaces, insulation, silica brick, checkers, and types of brick.

3. **Open Hearth Construction with Basic Brick.** H. M. Griffith. *Blast Furnace and Steel Plant,* v. 32, no. 1, Jan. '44, pp. 83-84.
Description of a basic brick furnace and the results of its operation since January 1943.

4. **Zircon Refractories for Aluminum Melting Furnaces.** R. W. Knauft. *Metals and Alloys,* v. 18, no. 6, Dec. '43, pp. 1326-1330.
Improvement of hearth and production rate and quality of metal with Zircon refractories.

5. **The Use of Basic-Lined Ladles in the Desulphurisation of Cast Iron by Sodium Carbonate.** *Metallurgia,* v. 29, no. 169, Nov. '43, pp. 17-19.
During recent years there has been a demand for a greater degree of desulphurisation than appears to be possible with soda ash in siliceous lined ladles. Experiments on the use of basic linings with the sodium carbonate process.

6. **Factors Influencing Staining of Silica Brick.** *Industrial Heating,* v. 11, no. 1, Jan. '44, pp. 122, 124.
Tests demonstrated that staining of silica brick occurred in a critical temperature range of 900-1000° C.

7. **Refractory Service Conditions in Electric Steel Furnaces. I. Arc Furnaces.** *Industrial Heating,* v. 11, no. 1, Jan. '44, pp. 112, 114, 116, 118, 120.
Conditions to which commercial refractories are subjected in acid and basic electric furnaces. 2 main types of electric furnaces described. Methods of installation.

8. **The Maintenance of the Furnace Linings in Large Basic Open-Hearth Tilting Furnaces by the Use of Chrome Ore, Magnesite and Serpentine.** A. Jackson. *Engineers' Digest,* v. 1, no. 2, Jan. '44, p. 116.
Efforts to reduce the magnesite consumption, even at the expense of increasing the chrome ore, later to reduce the chrome ore as well as magnesite consumed, and finally to replace both of these materials to the greatest possible extent by substitutes.

18. HEAT TREATMENT

1. **Sub-Zero Refrigeration.** G. B. Berlien. *Tool Engineer,* v. 13, no. 1, Jan. '44, pp. 99, 101-102, 104.
Tool life and performance are improved through incorporation of a refrigeration cycle in the heat-treating process. Results and methods of sub-zero treatments on various alloys and metal-cutting applications.

2. **Heat Treating Wrought Aluminum Alloys.** *Steel Processing,* v. 29, no. 12, Dec. '43, pp. 639-644, 647, 654.
Heat treating to increase strength of Al alloys 24S, 24S-O, 24S-T.

3. **Induction Heat Treating.** *Steel Processing,* v. 29, no. 12, Dec. '43, pp. 645-646, 648.
Half-trac sprocket hardening; tank transmission parts; bomb casings.

4. **Continuous Cooling Transformation Diagram, from Modified End-Quench Method.** C. A. Liedholm. *Metal Progress,* v. 45, no. 1, Jan. '44, pp. 94-99.
Jominy end-quench bars used to predict the structure and hardness of a steel when cooled in normal quenches. These data are used to decide whether a heat can be die-quenched in the regular routine.

5. **Progress in the Heat Treatment of Cast Iron.** J. S. Vanick. *Iron & Steel,* v. 17, no. 4, Dec. '43, pp. 203-206.
Difficulties encountered, stress relief, aging, gassy iron, machinability, and wear.

6. **There Is No Substitute for Good Heat Treatment.** A. S. Eves. *Modern Machine Shop,* v. 16, no. 8, Jan. '44, pp. 160-184.
Different methods of heat treating and hardening and various factors contributing to good results. Good design essential.

7. **Heat Treating Machine Gun Links.** John Ade. *Metals and Alloys,* v. 18, no. 6, Dec. '43, pp. 1339-1341.
Continuous clean-hardening and tempering furnace lines, details of mechanization, furnace construction, controls, quenching unit, draw-furnace recirculating equipment.

8. **Induction Hardening.** T. E. Eagen. *Steel,* v. 114, no. 4, Jan. 4, '44, pp. 76, 78.
Cuts heat treating time in half in production of diesel engine parts; originally planned for only 35 parts, application has been so successful that process is now used on more than 158 items.

9. **Sub-Zero Hardening Cycles.** G. B. Berlien. *Steel,* v. 114, no. 2, Jan. 10, '44, pp. 86-90.
A more completely heat treated structure may be obtained by subjecting the work to sub-zero temperatures following conventional heating and cooling methods. Physical characteristics of most steels may be definitely improved through further decomposition of austenitic structure at low temperatures.

10. **Sodium Cyanide for Carburising.** L. G. Whybrow Palethorpe. *Chemical Age,* v. 49, no. 1271, Nov. 6, '43, pp. 469-473.
Media, cyanide process, case composition and selective carburization. 2 ref.

11. **Modern Heat Treating Takes a Lot of Know-How.** A. S. Eves. *Iron Age,* v. 153, no. 2, Jan. 13, '44, pp. 62-63.
Summarizes the tried and untried proprietary and non-proprietary methods of heat treatment that have been introduced in recent years.

12. **Difficulties Encountered in the Heat-Treatment of Drop Forgings.** Bernard Thomas. *Metallurgia,* v. 29, no. 169, Nov. '43, pp. 11-14.
Heat-treatment begins with the heating of the steel preparatory to forging, and concludes with the final cooling, followed by the last heat-treatment operation. Heat-treatment difficulties.

13. **Coil Design for Successful Induction Heating.** Frank W. Curtis. *American Machinist,* v. 87, no. 26, Dec. 23, '43, pp. 94-96.
Details of solid-type induction coils arranged for single or multiple operation.

14. **Thin Case Hardening with Radio-Frequency Energy.** V. W. Sherman. *Electronic Engineering,* v. 16, no. 189, p. 229.
Induction heat-treating in the 1-20 megacycle frequency range.

15. **Pressure Quenching.** Metallurgicus. *Metal Progress,* v. 45, no. 1, Jan. '44, pp. 88-89.
Methods of quenching by means of oil jets, excellent for shafts, pins, broaches, and other long, straight pieces.

16. **Pittsburgh Commercial Heat Treating Plant Processes Ferrous and Non-Ferrous Metals.** A. M. Cox. *Industrial Heating,* v. 11, no. 1, Jan. '44, pp. 129-132, 134, 136-137, 140.
Types of furnaces used in the plant briefly described.

17. **Modern Heat Treating Takes a Lot of Know-How.** A. S. Eves. *Iron Age,* v. 153, no. 2, Jan. 13, '43, pp. 62-63.
Summary of all the tried and untried proprietary and non-proprietary methods of heat treatment that have been introduced in recent years.

18. **Controlled Gas Carburizing and Diffusion Cycles.** F. E. Harris. *Steel Processing,* v. 30, no. 1, Jan. '44, pp. 47-49.
The factors affecting the rate of carbon addition and the effects of these rates on the carbon gradient. The factors discussed are: Steel analysis, temperature of carburization, elapsed time and gas composition in the carburizing chamber.

(Turn to page 10)

Reveals Practical Aspects of Gases in Metals

—Zapffe

Reported by H. Y. Hunsicker
Research Metallurgist, Aluminum Co. of America

Cleveland Chapter—Three hundred members and guests gathered on Jan. 10 to hear Dr. Carl A. Zapffe, assistant technical director of the Rustless Iron and Steel Corp., present a lucid discussion of gases in metals.

Drawing a constitutional analogy between gas-metal relations and a hypothetical binary system involving two metals, one of extremely high melting point and another of relatively low boiling point, the speaker pointed out that the behavior of dissolved gases is often strongly analogous to the behavior of dissolved solids, the principal exception being that the precipitation of a gaseous solute results in an entrapped gaseous phase.

During solidification, that precipitation causes voids in the metal of either a blowhole or an interdendritic type, and during cooling through the solid range the precipitation within the grains may develop sufficient tri-axial stress to immobilize the slip elements. The metal is then brittle; in the case of hydrogen in steel, such defects as low ductility, flaking, and cracking, may occur.

If a coating—for example, enamel, paint, or electroplate—is placed on the outside of such metal, similar precipitation or "evaporation" of the gas may lead to interfacial pressures which deface the coating.

Oxygen, hydrogen, and nitrogen are the principal gaseous elements that dissolve in metals, but in ferrous metals hydrogen is almost alone in retaining its gaseous nature. Oxygen becomes important as a gas only through its combination with some other element, such as carbon to form CO. In some non-ferrous metals, such as silver, oxygen behaves truly as a gas.

Gases may best be eliminated from metals while the metal is still liquid. Passing a second gas which is "dry" with respect to the dissolved gas will "dry" the dissolved gas out of the metal just as moisture evaporates into dry air.

In some cases the gas may be eliminated to a sufficient degree by annealing, the temperatures being selected to provide an optimum rate of diffusion with a minimum of residual solubility.

During the discussion period, led by Dr. J. B. Clough, Dr. Zapffe described in more detail the chemical and microstructural processes involved in such gas phenomena as flaking and shatter cracks, "fish eyes," and low ductility at ordinary temperatures and intergranular attack at high temperatures.

—V—

Film on Gage Blocks Illustrates Precision

Manitoba Chapter—At a dinner meeting held on Jan. 13 in the Marlborough Hotel, Winnipeg, R. L. Crane of Savage, Minn., addressed 87 members and friends on "Precision Measurements in Industry".

Mr. Crane supplemented his talk by showing a film on gage blocks and precision measurements that provoked much discussion. A second film on "The Golden Gate Bridge" was also shown.

H. L. Johanneson of Manitoba Rolling Mill Co., Ltd., won the attendance prize.

Employment Service Bureau

Address answers care A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, unless otherwise stated.

POSITIONS OPEN

METALLURGICAL ENGINEER: For progressive automotive parts manufacturer near Detroit, now engaged entirely on war work. Should be thoroughly conversant with electroplating and all methods used for testing. Knowledge of plastics and rubber would be advantageous. Any reasonable salary will be met. Box 2-25.

WELDING METALLURGIST: For research work. Degree in welding and experience in metallurgy of welding. Base salary $225 to $300 per month for 40-hr. week; present 48-hr. week adds $50 to $60. Location Ohio. Box 2-30.

SALESMAN: Preferably with some tool and die steel selling experience for eastern and central Pennsylvania and Baltimore territories, representing established well-known producer. Statement of availability required; submit complete details on personal history and experience. Box 2-35.

METALLURGIST: For Houston plant of a manufacturer of oil drilling equipment. Interesting work with war contracts and assured activity in post-war period. Should have well-rounded experience and ability to build his department up from the ground. State qualifications, draft status, salary expectations and include recent photo. Box 2-40.

METALLURGIST: For arc welding electrode coating development located in the east. Experience not necessary. Box 2-5.

METALLURGIST: Two to five years' experience. For quality control in coreless induction and arc furnace foundry in mid-west. Excellent post-war possibilities. Submit complete record of training and experience and expected salary. Box 2-45.

PHYSICAL METALLURGIST: Able to carry on original research work involving patent and literature search and discussion of laboratory work. Good grounding in mathematics and theoretical physics. Excellent post-war possibilities. Submit complete record of training, experience, and expected salary. Mid-west. Box 2-50.

ENGINEER-METALLURGIST: Experience in welding and fabrication of light metals and steel, to do development work for large container manufacturer. Give details of experience. East. Box 2-55.

METALLURGIST: For electric steel foundry in Utah. Experience in production of acid electric and induction furnace steel. Must be graduate of accredited school with experience in practical foundry operation and ability to take charge of research program on alloy and heat resisting steels. Excellent post-war future for good man. Box 12-35.

SALES ENGINEERS: Established; with metal industry contacts. To handle sale of heat and corrosion resistant castings. Territories Philadelphia, St. Louis, Syracuse, Buffalo, Pittsburgh, Dayton, Bridgeport, Cincinnati. Box 2-60.

POSITIONS WANTED

HEAT TREAT SPECIALIST: 13 years experience, college background in chemical engineering and metallurgy; desires position to take charge in plant located on west coast. Box 2-10.

METALLURGICAL ENGINEER: Ph.D., with extensive industrial and teaching experience, desires to be associated with a university teaching and carrying out research work. Box 2-15.

SALES OR MILITARY ENGINEER: Being released from Armed Forces, Office of Chief of Ordnance as a captain; thoroughly familiar with government specifications and procedure. Over 20 years experience in technical engineering sales on automotive parts, trucks, diesel engines, industrial tractors, cranes, high frequency induction heat treating equipment. Territory optional. Box 2-20.

RESEARCH ENGINEER AND METALLURGIST: Exceptional experience in design, materials and treatments for reducing cost, weight and fatigue hazards. Desires position in research, engineering or designing department of an automotive, steel, farm implement or heavy machinery manufacturer. Box 2-65.

METALLURGICAL ENGINEER: Graduate, with eight years experience in both production and research; familiar with heat treating, metallography, and fabricating methods for aluminum and magnesium alloys, brass and steel. Experienced in processing practices used in manufacture of aircraft, refrigerators, cartridges, shells and tools. Acquainted with drawing, pressing, and stamping operations. Four years of supervisory experience. Available within two weeks. Box 2-70.

Boston Past Chairman Honored

Amos J. McDuff (Right) Receives a Past Chairman's Certificate From Chairman J. V. Baxter in Recognition of His Outstanding Service to the Boston Chapter (Photo by H. E. Handy)

Structural Changes Shown In High Speed Heat Treat

—Cohen

Reported by L. Geerts
Republic Steel Corp.

Boston Chapter—For the Jan. 7th meeting the chapter reached into its abundant store of expert home talent for its speaker, Dr. Morris Cohen, associate professor of metallurgy, Massachusetts Institute of Technology.

His subject "High Speed Steel—From the Inside", an old story to the audience, was presented from a modern or more fundamental viewpoint.

It is now possible to present a fairly satisfactory picture of the structural changes which occur during the heat treatment of high speed steel, Mr. Cohen said. A knowledge of these fundamental phenomena is very helpful in understanding the new heat treating practices, and in attaining the most complete utilization of the inherent capabilities of the steel.

Isothermal Annealing

Austenite decomposition in high speed steel is best described in terms of subcritical transformation curves. In the range of 1200 to 1400° F., the decomposition product is a relatively soft ferrite-carbide aggregate. This transformation may be employed as a basis for isothermal annealing, thus eliminating the need for cumbersome slow cooling.

Between 1150 and 700° F., the austenite is amazingly stable; it resists decomposition even on holding for hundreds of hours. Below 700° F., however, the austenite becomes reactive again, and transforms into bainite.

Two interesting features of this process are that *(a)* the austenite stops decomposing after about 50 to 60% bainite has formed, and *(b)* the remaining austenite becomes stabilized so that it persists on subsequent cooling to room temperature.

Second Tempering Advised

On tempering, complete conversion of the retained austenite results in an optimum combination of strength, toughness and hot hardness. However, the austenite transforms into untempered martensite on cooling from the tempering treatment. Hence, a second temper to toughen this secondary martensite and to relieve transformational stresses achieves even better properties.

When the hardening quench is arrested above room temperature in order to avoid possible cracking, an excessive amount of austenite is carried over into the tempering operation, and triple tempering becomes desirable.

If the hardening quench is continued to subzero temperatures, about 60% of the retained austenite can be transformed in this way. Slow cooling minimizes cracking, repeated cooling is superfluous, and prolonged holding at the low temperature is unnecessary. When followed by regular tempering, subzero hardening yields an unusual combination of tensile strength and ductility.

Technical Chairman Robert S. Rose, sales metallurgist, Vanadium-Alloys Steel Co., directed an active discussion period.

The showing of a moving picture released by the War Department, Office of Strategic Service, left the audience in a sober mood. Titled "Official Report by the General Staff" it showed the great task confronting our country in supplying our fighting forces and the difficulties to be faced in breaking down the strong defenses built up by our enemies.

Agricultural Note!

The controversy over McDuff's turnips and Bartholomew's cranberries begun at the December meeting of the Boston Chapter (see THE REVIEW for January, page 2) raged on at the January meeting.

Chairman James V. Baxter disclosed for the benefit of the 250 present the report of a secret investigation made into the activities of A. J. McDuff and his bigger and better turnips. Previous reports appear to be in error since a radically new plant food, namely, "Caster Oil Residue", was used to pep up the turnip exhibited at the December meeting.

Since this meeting Mr. Bartholomew has sold his cranberry crop as sauce!

Almost 37,000 women are working in steel mills today and 27,700 more in steel company offices. They account for about one-tenth of all steel employees.

—V—

By replacing many items of ordnance equipment formerly made of aluminum by steel, 119,000,000 lb. of aluminum has been made available to the aircraft industry, or about 10% of the current output of aluminum.

Position Wanted

PURCHASING AND PRODUCTION EXECUTIVE: with 22 years experience in steel industry, production machine shop and foundry industry is seeking permanent connection. Available immediately. Address C. E. Drake, 1621 Cedar St., Niles, Mich.

4 Experts on MetalForming Symposium

Reported by R. F. Harvey
Brown & Sharpe Mfg. Co.

Rhode Island Chapter welcomed four experts speaking on various phases of metal forming at the meeting on Dec. 1. Past Chairman W. M. Saunders acted as technical chairman, and the invasion of experts was led by the present chairman, R. C. Pranik, metallurgist of the American Screw Co.

He was followed by Harold Burke, assistant general superintendent with the Worcester Pressed Steel Co., L. W. Gallup, superintendent of the Rhode Island Tool Co., and Francis Locke, superintendent of the Newman-Crosby Steel Co.

Pranik Discusses Cold Heading

Mr. Pranik discussed cold heading and outlined the main steps in the manufacture of screws by upsetting blanks to form the desired shape of head, followed by rolling the threads. He explained the construction and action of single, double, and multiple stroke machines.

Cut and rolled threads were compared. Thread rolling cold works the metal and upsets the grain flow, resulting in increased strength. Threads of fine pitch and made to National Standard Class 4 and 5 fit are being rolled commercially. A lively discussion followed on the merits of rolled and cut threads.

Harold Burke discussed the trials and tribulations of a cold stamping engineer.

In cold forming, the metal must be stressed beyond the elastic limit but within the breaking strength. There are many factors which defy accurate calculation, and plastic forming of metals by cold forming and drawing is more of an art than a science.

Typical pressed parts were demonstrated, including a propeller hub cap. Mr. Burke explained the action of ironing dies in thinning the walls of this part.

Forging Industry Traced

L. W. Gallup traced the early history of the hot forging industry in New England. Although the forging industry received its early start in the east, over 60% of all forgings are now made in the east central states near the automobile centers.

Hot forging was defined as the plastic forming of hot metals by impact or pressure.

Mr. Gallup explained the principal steps in the production of a typical drop forging, including the operations of inserting the bar in the drop hammer, forging, stamping or removing the flash, and scale removal. He brought with him a number of drop forgings, including micrometer frames which are produced with a finish so smooth that enameling can be done without extensive preparatory polishing.

Francis Locke explained that cold rolling is the simplest of the various methods used to cold form metals. Cold rolled strip mills start with flat hot rolled pickled strip of the rimmed type and produce cold rolled strip. Gage tolerances, hardness, surface, flatness, and edges must be carefully controlled.

Cold working by definition implies working at any temperature below the critical but actually most cold rolling is done at room temperature. Occasionally on the final pass the temperature may reach 200 to 250° F.

The symposium was highly successful, as evidenced by the excellent turn-out and the lively discussion period.

—V—

Mexico, with an estimated 600,000 tons of annual steel making capacity, is the leading steel making nation south of the Rio Grande.

Heat Treating Tricks Told New Jersey
—Gibbons

Reported by R. L. Rickett
Research Laboratory, U. S. Steel Corp.

New Jersey Chapter—Success in heat treating comes from a sound knowledge of fundamental principles, experience, and common sense—so stated R. C. Gibbons in an address on Jan. 17 entitled "Tricks in Production Heat Treatment".

Mr. Gibbons, who is production metallurgist, Eclipse-Pioneer Division, Bendix Aviation Corp., replaced the speaker originally scheduled for this meeting, Alexander Ross of the same organization, who was unable to be present. The technical chairman, also a "pinch-hitter", was R. J. Metzler, vice-president of the B-M Heat Treating Co. of Newark.

Differential Hardening Methods

The speaker discussed several methods of differential hardening, one of which consists of quenching only that part of the piece that is to be hardened; as an illustration of this he described the time-honored method used by blacksmiths to harden chisels. More recent developments along this line are flame hardening and induction hardening.

Localized tempering by means of flame or induction heating, or by partial immersion in a lead bath, may also be used to make part of the piece softer than the rest.

A novel method was described in which carefully controlled time quenching was employed to harden relatively thin projecting portions of a particular part, leaving the thicker portions in a softer condition.

Distortion and Cracking Minimized

Mr. Gibbons discussed in some detail nitriding and carburizing practice and the various methods used in heat treating carburized parts. He stated that in addition to its normal uses, carburizing may be employed in an emergency to restore the carbon content at the surface of parts decarburized in some stage of processing, although he does not recommend this as a regular practice.

The heat treater is always faced with problems of distortion and cracking and the speaker discussed some of the ways in which these may be minimized. He stated that steels containing 0.35% carbon or less usually may be safely water quenched, while those having 0.40% or more carbon are likely to crack unless quenched more moderately.

The heat treater cannot properly be blamed for grinding cracks; however, he can help to avoid them by proper tempering, particularly by increasing the tempering time.

—V—

Latin American nations will have a combined capacity for producing approximately 1,400,000 tons of steel ingots and castings upon the completion of certain new plants now under construction.

CHAPTER CALENDAR

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Baltimore	Mar. 20	Engineers Club		
Boston	Mar. 3	Hotel Sheraton	A. Allan Bates	Plastics Vs. Steel
Calumet	Mar. 14	Phil Smidt's Rest., Roby, Ind.	C. D. Lowry, Jr.	New Developments in Petroleum Technology
Canton-Mass.	Mar. 17	Elks Club		Mid-Winter Party
Chicago	Mar. 9	Chicago Bar Association	C. L. Clark	Alloys for High Temperature Uses
Cleveland	Mar. 6	Cleveland Club	James F. Lincoln	Some Aspects of Post-War Problems
Columbus	Mar. 14	Fort Hayes Hotel	Don Judd	Application of Gray Cast Irons
Detroit	Mar. 13	Horace H. Rackham Bldg.	D. K. Crampton	Non-Ferrous Alloys
Georgia	Mar. 6	Holsum Restaurant	Stanley P. Watkins	Practical Metallurgy of Stainless Steel
Golden Gate	Mar. 20	Engineers Club	M. A. Grossmann	Effects of Alloys in Steel
Hartford	Mar. 14	City Club	F. L. LaQue	Fundamentals of Corrosion
Indianapolis	Mar. 20		A. E. Focke	Tempering
Lehigh Valley	Mar. 3	Hotel Bethlehem, Bethlehem, Pa.	H. L. Maxwell	Metallurgical Problems in Chemical Manufacture
Louisville	Mar. 21	Kentucky Hotel	Harry B. Osborn, Jr.	Induction Heating
Mahoning Valley	Mar. 14	Y. M. C. A.	H. L. Smith	Electric Furnace Steels
Manitoba	Mar. 9	Marlborough Hotel, Winnipeg	W. Lathrop	Ferro-Alloys
Milwaukee	Mar. 21	Athletic Club	David C. Zuege	Recent Developments in Castings
Montreal	Mar. 6	Ritz Carlton Hotel	M. A. Grossmann	Hardenability and Effect of Alloys
New Haven	Mar. 16	Hotel Elton, Waterbury	Walter R. Meyer	Modern Metal Finishing
New Jersey	Mar. 20	Essex House, Newark	R. W. Thompson	New Developments in Ferrous and Non-Ferrous Forging Practice
New York	Mar. 13	Bldg. Trade Employers Assoc.	C. G. Stephens	Inspection and Identification of Engineering Materials
North West	Mar. 7	Coffman Memorial Union, Univ. of Minn.	Martin J. Stesin	Metallizing
Notre Dame	Mar. 8	Engineering Audit., Univ. of Notre Dame	W. G. Hildorf	Metallurgical Testing in an Alloy Steel Mill
Ontario	Mar. 3	Hamilton	J. D. Hanawalt	Magnesium Alloys
Ontario	Mar. 31	Toronto	K. C. Compton	Protection of Metals From Corrosion
Oregon	Mar. 17	Imperial Hotel	M. A. Grossmann	Principles of Heat Treatment
Philadelphia	Mar. 24	Engineers Club	N. E. Woldman	Aluminum and Magnesium Sand Castings
Pittsburgh	Mar. 9	Roosevelt Hotel	J. O. Almen	Effect of Residual Stresses on Strength of Materials
Puget Sound	Mar. 15	Washington Athletic Club	M. A. Grossmann	Principles of Heat Treatment
Rhode Island	Mar. 1	Providence Engrg. Society	A. S. Jameson	Conservation of Materials Through the Use of Carbon and NE Steels
Rochester	Mar. 13	Lower Strong Audit., Univ. of Rochester		Steel—Man's Servant
Rockford	Mar. 22	Faust Hotel	G. B. Berlien	Practical Heat Treating
Rocky Mountain	Mar. 17	Oxford Hotel, Denver	John Robb	Cast Iron
Saginaw Valley	Mar. 21	Bancroft Hotel, Saginaw, Mich.	Carl E. Swartz	Modern Developments in Bearings
Springfield	Mar. 20	Mansion House, Greenfield, Mass.	H. E. Replogle	Tool Steels
St. Louis	Mar. 17	York Hotel	C. W. Schemm	Electronics
Syracuse	Mar. 7	Onondaga Hotel	W. G. Theisinger	Welding of Carbon and Certain Low Alloy Steels
Texas	Mar. 14	Houston Country Club	C. E. Betz	Interpretation of Magnaflux Indications
Toledo	Mar. 27	Hotel Hillcrest		Fatigue Analysis and Photo-Elastic Studies
Tri-City	Mar. 14	Hotel Ft. Armstrong, Rock Island, Ill.		Metallurgical Quiz Night
Warren	Mar. 13	Y. W. C. A.	W. F. Hess	Spot Welding of Hardenable Steels
Washington	Mar. 13	Garden House, Dodge Hotel	A. B. Kinzel	
West Michigan	Mar. 20	Rowe Hotel, Grand Rapids	H. W. McQuaid	Specification and Selection of Steels
Worcester	Mar. 8	Boys Trade School	A. Bradford Reed	Developments in Precision Thread Rolling
York	Mar. 8	27 W. Orange St., Lancaster, Pa.	W. E. Martin	Practical Metallurgy of Beryllium Copper

HERE AND THERE WITH A.S.M. MEMBERS

WALTER G. HILDORF, who recently became director of metallurgy of the Timken Roller Bearing Co., is the first to occupy that newly created office. Hildorf was formerly Timken's chief metallurgical engineer, a position now held by Ralph L. Wilson.


W. G. Hildorf

Hildorf, metallurgical veteran of 35 years' experience, who "worked his way" through Michigan State College via a machine shop, is nationally known for his numerous articles and lectures on many metallurgical subjects.

He joined the Timken company in 1928, after 20 years' experience with such firms as the Copper Range Consolidated Mining Co. and The Reo Motor Car Co. For three of those years, from 1917 to 1920, he was first an instructor and later an associate professor in the metallurgical department of Michigan State College.

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ROY G. ROSHONG, for the past two years engaged in consulting work with Harvey S. Pardee and Associates of Chicago, is now with Reynolds Metals Co. in Louisville, Ky., as technical advisor at Plant No. 7.


R. G. Roshong

Mr. Roshong was metallurgist with Lindberg Steel Treating Co. from 1936 to 1942. Before that he was metallurgist of the Hoover Co. in Canton, Ohio, and is a past chairman of the Canton-Massillon Chapter A.S.M.

He is a graduate metallurgical engineer from University of Cincinnati and held various positions in Canton and Dayton before going to Chicago.

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V. C. MEKEEL, superintendent of foundries of Ampco Metal, Inc., of Milwaukee, Wis., has resigned to accept the management of product engineering and sales development for Syncro Machine Co., Rahway, N. J.

Mr. Mekeel has been active in the metal industry for the past 25 years in plant operation, engineering, metallurgical and sales capacities. He was formerly associated with The Bethlehem Steel Co., Taylor-Wharton Iron & Steel Co., Sivyer Steel Casting Co., and the Mekeel Engineering Co.

150 Attend Rochester National Officers' Night

Reported by E. A. Schlaerth
District Sales Manager
Peter A. Frasse & Co.

Rochester Chapter's January meeting, which was National Officers' and Past-Chairmen's Night, brought forth 150 members and friends to hear National Secretary W. H. Eisenman and Vice-President Kent R. Van Horn.

Mr. Eisenman was introduced by Mr. McDonald, who is the oldest charter member of the Rochester Chapter, and gave a short review of the Society's accomplishments during the past 25 years. He pointed out that it is now the third largest technical group in the world.

Dr. Van Horn, research metallurgist of the Aluminum Co. of America, gave a technical address on "Application of Aluminum Castings and Wrought Alloys", covering their general and physical properties and applications.

Substitution of steel for copper in numerous parts of combat tanks has saved 3,000,000 lb., while a revision of steel specifications for artillery saved 11,000,000 more lb. of copper and copper alloys.

Coleman Describes Thin Film Method To Measure Diffusion

Reported by Louis Keay
Pennsylvania State College

Penn State Chapter—Dr. Howard A. Coleman, instructor in physics, The Pennsylvania State College, speaking before the meeting on Dec. 16, discussed diffusion in metals and described the thin film method of diffusion rate measurement which he developed in cooperation with Dr. Henry L. Yeagley in 1942.

This method, notable for providing a quick and accurate means of measuring diffusion at low temperatures, consists briefly of vaporization of two metals from cavities in an electric filament and successful deposition to form a very thin two-layered intermetallic film.

This film at constant temperature is made to reflect light from a constant source to a photo-electric cell. A recording microammeter connected to the cell records change in the reflectivity of the intermetallic film surface as diffusion progresses.

The members present found Dr. Coleman's talk very provocative and a lengthy discussion of diffusion and related phenomena ensued.

—V—

Ship Shortage Eased By Stainless Steel In Chemical Plants

At crucial times during World War I, the loss of a single freighter carrying a load of nitrate from Chile could have been a more serious blow than the sinking of a large cruiser. Huge quantities of nitrates were being consumed in making nitric acid, the basis of TNT and gunpowder.

Today the United States does not have to rely on imports for its supplies of nitric acid because nitrogen and nitric acid are now extracted from the atmosphere.

Twenty-five years ago there was no steel available that could stand up under the severe corrosive action and the high temperatures and pressures encountered in obtaining nitrogen and nitric acid from ordinary air in large quantities. Today the steel industry is producing stainless steels that meet the severest tests of such service.

Review of Current Metal Literature—(Continued)

18. HEAT TREATMENT

(Continued from page 7)

19. Characteristics and Applications of Controlled Atmospheres for Heat Treating. C. E. Peck. *Steel Processing*, v. 30, no. 1, Jan. '44, pp. 50-51.

The combustion properties of fuel gas for controlled atmosphere heat treating.

20. Heat Treatment and Aging of 24S Aluminum Alloys. Max E. Tatman and Ray A. Miller. *Iron Age*, v. 153, no. 4, Jan. 27, '44, pp. 50-55.

Tests on 24S clad aluminum alloy sheets and 24S extrusions, undertaken by Consolidated Vultee Aircraft Corp., are summarized. These reports embrace investigations on aging at temperatures from 325 deg. to 400 deg. F.; the effect of plastic deformation on aging characteristics and the degrees to which variations in deformation affect aging results; corrosion tests on aged alloys; and the effect of heat on mechanical properties and on color of protective coatings and camouflage finishes.

21. Subzero Unit on the Assembly Line. *Iron Age*, v. 153, no. 4, Jan. 27, '44, p. 49.

Automatic feeding of steel valve inserts through a standard Deep-Freeze unit, by the Dodge Div. of Chrysler Corp. at its main plant in Detroit.

22. "Pressure-Quench" Machine Minimizes Distortion of Quenched Armor Plate. C. A. Maurer. *Industrial Heating*, v. 11, no. 1, Jan. '44, pp. 28, 30, 32, 34, 36.

Installation at Drever Co., Phila., Pa.

19. WORKING

Rolling; Drawing; Pressing; Forging

1. Determining Defects in Forgings. *Steel*, v. 114, no. 4, Jan. 4, '44, pp. 60-61.

Table listing type of defect, alloy composition, melting, pouring, processing stock, heating prior to forging, forging equipment, design of forging, forging operation and heat treatment.

2. Forged and Coined Gears. *Steel*, v. 114, no. 3, Jan. 17, '44, pp. 78-80, 116-118.

Save 50% stock; reduces cost; NE Steel meets requirements; special gear cutting equipment need eliminated.

3. Fabricating 18-8 Stainless. Jerome Wilford. *Tool Engineer*, v. 13, no. 1, Jan. '44, pp. 65-70.

Budd Mfg. Co. produces more than 50 million lb. of stainless steel parts. 18-8 austenitic used; stamping and pressing operations, contour machines, stretching fixtures discussed.

4. Steel Processing. *Steel Processing*, v. 29, no. 12, Dec. '43, pp. 623-626.

The Piger process is a unique method of producing seamless tubing. After cylindrical billets are pierced, the rolling process differs fundamentally from the usual method of completing tubes. The elliptical rolls used to form the tubing rotate in a direction opposite to the feed of the steel which is pressed against the rolls by a ram. The steel is fed forward by the ram when the pass between the rolls is wide.

5. Chemical and Physical Control in Relation to Rolling and Deep-Drawing Industries. C. Stuart Dobson. *Metal Industry*, v. 63, no. 25, Dec. 17, '43, pp. 386-388.

In the system are outlined the chief requisites as follows: (1) A routine laboratory for chemical and physical control. (2) An applied research or experimental department. (3) A pure research department. (4) A statistical department.

6. Fabrication of Aircraft Parts. F. C. Hoffman. *Iron Age*, v. 153, no. 3, Jan. 20, '44, pp. 60-67.

The problem of springback in formed parts, such as those with flanges, is related to basic stress-strain theory and the plastic behavior of metal. Tests show that per cent elongation values for a given material vary widely, depending upon the distance between gage points in the tensile specimen.

7. Tubes and Tube Making. Bernard P. Planner. *Iron Age*, v. 152, no. 27, Dec. 30, '43, pp. 54-56.

The advantages of drawing. The Rockrite process which utilizes compressive rather than tensile stresses to accomplish reduction is described.

8. Mass Production of Kirksite Blanking Dies. W. W. Broughton. *Iron Age*, v. 153, no. 3, Jan. 20, '44, pp. 70-74.

Flat plow steel punches are used in conjunction with rolled Kirksite "A" zinc alloy dies, which are broached to final size by the punch itself. The soft dies are self-sharpening. The practice in making such dies in a number of aircraft plants is reviewed.

9. Method of Forming Aluminum Alloy Extrusions and Preformed Sheet Metal Sections. William Schroeder. *Automotive & Aviation Industries*, v. 90, no. 2, Jan. 15, '44, pp. 28-31, 100.

Manual and semi-manual, and machine forming methods. Advantages of the method discussed: (1) Simple roll profiles are maintained. (2) Bending may be accomplished about axes other than the minimum principal axis and (3) Angle changes between flanges and web or between flanges in the cross-section of the extrusion may be produced by this method.

10. Boeing Die Pierces 976 Holes in 10 Parts During 5 Press Operations. *Automotive & Aviation Industries*, v. 90, no. 2, Jan. 15, '44, pp. 40, 102, 104.

Catwalk piercing die incorporates 388 punches with a hole location accuracy of .0005". This die pierces 976 riveting holes in 10 separate parts and production time is improved 34 times over former method.

11. Pressure Forming of Metals. C. L. Davidson and W. E. Bloom. *Western Metals*, Jan. '44, pp. 7-8.

Process developed for forming aluminum hydraulic fittings is adaptable to forming other metals and more complicated shapes.

12. Power Consumption in the Rolling of Steel Shapes. M. Steffes. *Engineers' Digest*, v. 1, no. 1, Dec. '43, pp. 22-24.

The relationship between hourly mill output and shapes rolled.

13. Roll More Tons—VI. A. E. Lendl. *Iron & Steel*, v. 17, no. 4, Dec. '43, pp. 173-179.

Investigation of the first forming pass of beam calibration.

14. Shell Forgings on Bulldozers. *Machinery (London)*, v. 63, no. 1622, Nov. 11, '43, pp. 539-543.

Description of three methods by which bulldozers have been adapted to the forging of high-explosive shells: (1) Progressive pierce-and-draw method. (2) Method by which the bulldozer pierces in one stroke. (3) The French extrusion process.

15. Improved Wire-Working Machines. A. G. A. *Machinery (London)*, v. 63, no. 1621, Nov. 4, '43, pp. 516-519.

Structural details of machines for straightening, cutting-off, and automatic forming of wire.

16. Stretching Structural Parts for Aircraft. F. C. Hoffman. *Machinery (London)*, v. 63, no. 1623, Nov. 18, '43, pp. 561-570.

Stretch forming tests and production methods of Al alloy sheet.

17. The Design of Stampings for Quantity Production. R. A. W. *Machinery (London)*, v. 63, no. 1625, Dec. 2, '43, pp. 627-629.

Nine classes of stampings and the properties of the various metals which may be used for stampings.

18. Production Short-Cuts on Aircraft Parts. R. H. R. *Machinery (London)*, v. 63, no. 1626, Dec. 9, '43, pp. 645-650.

Smoothing out wrinkles, use of Zn alloy dies for blanking and forming, milling operations.

19. Parts Straightening Without Heat Treatment. J. A. Chamberlin. *Aero Digest*, v. 44, no. 1, Jan. 1, '44, pp. 84, 88, 219.

Value of cold-straightening technique in salvaging of aircraft parts. Procedure whereby residual stresses produced by bending to point of permanent set and subsequent straightening out of part are evaluated to determine airworthiness.

20. Shaping Metal Airframe Parts. *Aircraft Production*, v. 5, no. 62, Dec. '43, pp. 566-571.

Drop-hammer, rubber die and stretch-pressing equipment at a de Havilland factory.

21. The Wire Drawing Die. Flint C. Elder. *Wire and Wire Products*, v. 19, no. 1, Jan. '44, pp. 23-33.

The tungsten carbide die as used in the dry drawing of steel wire of circular cross section as distinguished from shape wire.

22. Drawing Fine Uncoated Steel Wire. R. R. Preston. *Tool & Die Journal*, v. 9, no. 10, Jan. '44, pp. 117-119.

Successful drawing of fine uncoated steel wire depends on good dies and die maintenance; proper patenting; liming with correct grade of lime, proper baking and complete cleaning.

23. Improved Tube Fabrication. *Steel*, v. 114, no. 5, Jan. 31, '44, pp. 72-74.

Equipment used in the fabrication of parts from tubing, Duer Tube Bending Co., Chicago.

24. Forging and Heat Treatment of Anti-Tank Shot. R. M. P. *Machinery (London)*, v. 63, no. 1628, Dec. 23, '43, pp. 709-714.

Methods used at Axelson Mfg. Co. in forging armour-piercing shot bodies and caps for 37-mm. projectiles used in anti-tank guns, along with various other munitions items.

25. Manipulation of Light Alloy Sections. J. Aherne Heron and L. N. Hocking. *Aircraft Production*, v. 6, no. 63, Jan. '44, pp. 3-4.

A suggestion for an improved method by direct electrical heating. May be used for production bending.

26. Aluminum at Trentwood. T. J. Ess. *Iron & Steel Engineer*, v. 21, no. 1, Jan. '44, pp. 51-57.

First aluminum sheet mill west of the Mississippi River and one of the largest in the country, this plant was built in record time for DPC. With some variations for the metallurgy of the product, the practice is quite similar to the continuous production of steel sheets.

27. Some Observations on Plate Mills. W. A. White. *Iron & Steel Engineer*, v. 21, no. 1, Jan. '44, pp. 29-33.

The new plate mill of Kaiser Co., Inc., at Fontana, California, and some practical plate mill operating suggestions.

28. New Brass Mill. *Steel*, v. 114, no. 5, Jan. 31, '44, pp. 90-92, 114.

Innovations incorporated in a new brass mill constructed by Bridgeport Brass Co. at Indianapolis for the Ordnance Department, which increases speed and capacity.

29. Light-Alloy Forgings. *Aircraft Production*, v. 6, no. 63, Jan. '44, pp. 13-16.

Large-scale equipment used in a plant of the Chevrolet Division of the General Motors Corp. for cogging-down aluminium ingots to increase their tensile strength for the forging of aircraft-engine crankcase sections. Ingots heated in the furnace are transferred by the claw-ended boom on the carrier-mounted turntable to the cogging-down press. This press exerts a pressure of 3,000 short tons and reduces the section of the ingot from 12 by 12 in. to 9 by 9 in. A bank of tanks contains air and water under a pressure of 4,500 psi. for operating the hydraulic press.

30. Aluminum Forging Practice. *Steel*, v. 114, no. 5, Jan. 31, '44, pp. 76-80.

A study of the four phases of aluminum forging practice: Die design, metallurgical problems, inspection of raw materials, and standardization of test pieces.

31. Auxiliary Plate Set System Accelerates Multiple Punching. Frank H. Limburg. *Aero Digest*, v. 44, no. 2, Jan. 15, '44, pp. 130-132.

Any number of holes in an almost unlimited number of designs can now be perforated with one hit of the press with the Wales Plate Set Assembly. This consists of two plates, separated by spacer bars, the punches being held in the upper plate and the corresponding dies in the lower. This is located on the platen of a press, the work pushed in between the plates and the head of the press dropped to push all the punches through simultaneously. It is a development of the Wales-Strippit Corp.

20. MACHINING AND MACHINE TOOLS

1. Calibrated Handwheel for Turret Lathes. *Iron Age*, v. 153, no. 3, Jan. 20, '44, p. 69.

Handwheel for turret lathe cross-slide longitudinal travel, used with or without the regular machine stops, has been devised at the Pittsfield works of the General Electric Co. to enable even inexperienced operators to obtain closer and more uniform dimensions than can be obtained with stops alone.

2. Hydraulic Fixture Aids Broaching Operation. *Iron Age*, v. 153, no. 3, Jan. 20, '44, p. 67.

Deep slots are being successfully broached to close tolerances on small parts with the aid of a special hydraulically actuated clamping fixture.

3. Dynamite as a Machine Shop Tool. Seward A. Covert. *Modern Machine Shop*, v. 16, no. 8, Jan. '44, pp. 194-200, 205-208.

Simple, effective means of removing broken drills from crankshafts with explanation of technique.

4. Tooling for Boring and Facing Torpedo Ends. *Machinery (London)*, v. 63, no. 1624, Nov. 25, '43, pp. 595-597.

Description of a special tooling unit applied to the 4-F platen type Foster Fastermatic for boring and facing torpedo ends.

5. Broaching Oblique Holes. W. Cooper. *Machinery (London)*, v. 63, no. 1626, Dec. 9, '43, pp. 653-655.

Production difficulties, tensile safety factor, teeth, squaring the circular bore.

6. Fine Boring Practice. W. Boneham. *Machinery (London)*, v. 63, no. 1627, Dec. 16, '43, pp. 673-679.

The principle of fine boring is a high spindle speed, a very fine feed and a light cut. Due to exceptionally low machining stresses, very light clamping arrangements can be made, avoiding distortion of the component. Versatility of fine boring, spindle accuracy, diameter variation by quill adjustment, diamond, feed and surface speed also treated.

7. The Relief of Formed Cutters. J. G. Smith. *Machinery (London)*, v. 63, no. 1624, Nov. 25, '43, pp. 599-602.

Study of the technique of applying relief to the teeth of rotary-type cutting tools. Description of methods of determining the form of the relieving curve and processes of relieving various forms of cutters.

8. Eccentric Gear Mechanisms for Variable Angular Velocity. P. G. *Machinery (London)*, v. 63, no. 1624, Nov. 25, '43, pp. 603-604.

Practical application of eccentric gear mechanisms for variable angular velocity.

9. Unusual Grinding Applications on Small Parts. *Machinery*, v. 50, no. 5, Jan. '44, pp. 165-166.

Method for grinding two eight-sided cams from two different diameter rounds.

10. Securing Fine Surface Quality. H. J. Wills. *Machinery (London)*, v. 63, no. 1621, Nov. 4, '43, pp. 513-515.

Grinding machines, reconditioning spindles, factors affecting grinding.

11. Securing Fine Surface Quality by Grinding. H. J. Wills. *Machinery (London)*, v. 63, no. 1626, Dec. 9, '43, pp. 657-659.

Selection and correct application of abrasives.

12. Securing Fine Surface by Grinding. H. J. Wills. *Machinery (London)*, v. 63, no. 1627, Dec. 16, '43, pp. 690-691.

Wheel selection and speeds.

13. How to Secure Fine Surfaces by Grinding. H. J. Wills and A. J. Ingram. *Machinery*, v. 50, no. 5, Jan. '44, pp. 173-175.

Balancing of grinding wheels and its effect on fine surface quality.

14. Profiling Shells for Aircraft Cannon. *Machinery (London)*, v. 63, no. 1624, Nov. 25, '43, pp. 589-591.

Description of an automatic profile turning machine used in the production of shells for aircraft cannon.

15. Recent Applications of Carbide Cutters. Abstract of a paper by H. A. Oldenkamd and James McFayden. *Machinery (London)*, v. 63, no. 1622, Nov. 11, '43, pp. 546-547.

Diagrams and descriptions of the application of carbide cutters to processing on turret lathes, to boring machines and planers.

16. Heavy-Duty Gears. W. P. Schmitter. *Tool Engineer*, v. 13, no. 1, Jan. '44, pp. 87-90.

Large industrial and marine gears are hobbed, shaped and shaved to precise specifications. Important complementary factors are alloy content, heat treatment, fabrication of castings, tests, and assembly.

17. Calculations for Screw Machine Cams. A. Ainsworth. *American Machinist*, v. 88, no. 1, Jan. 6, '44, pp. 91-93.

Five tried methods for figuring thread lobe rise on Brown & Sharpe automatics.

18. Rolls for High Speed Milling—and for Shell Forging. Nelson G. Meagley. *Metal Progress*, v. 45, no. 1, Jan. '44, pp. 91-93.

Problems of tool design, and machinability; "negative rakes" and the cyclonic speeds on aluminum and magnesium and on steel; metal cutting; forging steel shells. Account of A.S.M.E. Dec. '43 Convention.

19. Shaving Aircraft Gears. Richard S. Kegg. *Tool Engineer*, v. 13, no. 1, Jan. '44, pp. 91-94

Description of processes preceding shaving; reviews the grinding process, and inspection methods employed in precision gear manufacture.

20. Screw Machine Progress. John E. Hyler. *Tool Engineer*, v. 13, no. 1, Jan. '44, pp. 72-76.

Attachments for burnishing, cross-drilling, and eccentric hole drilling.

21. Machining the Wright Cyclone Forged Cylinder Head. H. E. Linsley. *Iron Age*, v. 153, no. 2, Jan. 13, '44, pp. 46-53.

Special purpose machine tools devised to machine this head are described and illustrated. Machining time has been increased but a difficult and tedious foundry job has been eliminated.

22. Machining Parts for Flying Fortresses. *Machinery (London)*, v. 63, no. 1621, Nov. 4, '43, pp. 505-507.

Boeing production methods.

23. Hyper-Milling with Carbide Cutters. R. G. O. *Machinery (London)*, v. 63, no. 1625, Dec. 2, '43, pp. 617-622.

Normalized wing fittings forged from S.A.E. 4140.

Review of Current Metal Literature

20. MACHINING
(Continued from page 10)

24. Speeding Up Production by Multiple Vertical Turret Lathe Tools. C. W. Heckert and R. Santoro. *Machinery*, v. 50, no. 5, Jan. '44, pp. 176-177.
Method of using multiple tools for rough-facing, parting, finish facing and burring of electrical contact rings machined from a solid brass plate.

25. Grinding Steel Crankcases for Aircraft Engines. *Machinery (London)*, v. 63, no. 1627, Dec. 16, '43, pp. 681-686.
Special methods and equipment.

26. Ideas from Practical Men. *American Machinist*, v. 87, no. 26, Dec. 23, '43, pp. 99-101.
Nut arbor centers castings on turret lathe; prevents transformer failures on spot welders; lug added to casting simplifies machining; roller replaced by straight shanked stamps; tubing keyways made without machining; inexpensive piercing punches for thin stock; pin gages check bores in small-lot jobs.

27. Ideas from Practical Men. *American Machinist*, v. 88, no. 1, Jan. 6, '44, pp. 99-101.
Celluloid guards protect Sheffield gages; milling fixture designed for the drill press; diesel locomotive axles ground on a standard lathe; surface grinder attachment for finishing cams; pointed lever simplifies burring operation; bar stock transferred vertically to screw machines.

28. Rebuilt Machine Bores Bearings. C. A. Bloom and Merl Harkless. *American Machinist*, v. 87, no. 26, Dec. 23, '43, p. 93.
A boring spindle added to base of an internal grinder.

29. Carbide-Tipped Cutters Speed Steel Milling. Fred W. Lucht. *American Machinist*, v. 87, no. 26, Dec. 23, '43, pp. 105-114.
Cutting and relief angles, number of teeth and power, fly-milling cutters, machine requirements, operating precautions, and climb milling vs. conventional milling.

30. Grinding Procedures Set for Glass Gages. *American Machinist*, v. 88, no. 1, Jan. 6, '44, pp. 83-86.
Close tolerances and transparent finishes on these gages require deviations from usual grinding practices.

31. Diamond Turning. *Automobile Engineer*, v. 33, no. 444, Dec. '43, pp. 531-532.
Experimental data on the machining of aluminum alloys.

32. Diamond Turning. *Aircraft Production*, v. 5, no. 62, Dec. '43, pp. 592-594.
Measuring surface finish graphically, cutting data, results.

33. How to Grind Carbide Form Tools. *Western Metals*, Jan. '44, pp. 15-17.
Steps in training operation for grinding of carbide form tools.

34. Machining, Bending, Straightening, Aluminum Alloys. G. R. Gwynne. *Western Metals*, Jan. '44, pp. 22-24.
Record of all data of a general or technical nature concerning operations on 14S-T and 24S-T material at the Douglas Aircraft Co. Spar Cap Factory.

35. Streamlined Production: Production Economy with Modern Methods. *Tool Engineer*, v. 13, no. 1, Jan. '44, pp. 78-86.
Includes following topics: Motor frames are machined in balanced operations; grinder head on boring mill; holes drilled in aluminum bronze, drill shanks brazed; shaper and planer tools raised automatically; scrap micarta solves problem of threading slotted studs; gang milling cutter set-up cuts machining time; furnace brazing speeds joining operation, improves product; spot welding fixtures braze electrical contacts; induction heating solders metal to porcelain; spot welding; projection welding; two hinge parts produced simultaneously in press operation; indexing fixture on press saves milling operations; hot pressing; heavy-gauge part is blanked; "squirting" produces large-size copper tubing.

36. Machining the Wright Cyclone Forged Cylinder Head. H. E. Linsley. *Iron Age*, v. 153, no. 2, pp. 46-53.
Some of the unusual special purpose machine tools devised to machine this head are described and illustrated, the most interesting of which are the automatic units for milling out the cooling fin slots. Machining time has been increased but a difficult and tedious foundry job has been eliminated.

37. Twist Drill Data for the Designer. C. W. Hinman. *Tool & Die Journal*, v. 9, no. 10, Jan. '44, pp. 86-90.
Designs for drilling jigs and tapping fixtures. Grinding drill points; combination drills; entering drills in jig bushings; drilling speeds; feed revolution of drill; drilling lubricants and coolants.

38. 10-In. by 27-In. Precision Grinding Machines. *Engineering*, v. 156, no. 4067, Dec. 24, '43, p. 505.
Grinding machines with mechanically-operated table movements. A 10 by 27-in. precision grinding machine, the dimensions referring respectively to the diameter of the maximum swing and the maximum length that can be ground between the workhead and tailstock centers.

39. Screw Machine Progress. John E. Hyler. *Tool Engineer*, v. 13, no. 1, Jan. '44, pp. 72-76.
Attachments for burnishing, cross-drilling, and eccentric hole drilling are featured in this fourth in a series of articles on increasing the range and functions of automatic screw machines.

21. CLEANING AND FINISHING

1. Precleaning with Solvent Emulsions. C. S. Lowe. *Review, American Electroplaters' Society*, Jan. '44, pp. 29-40.
Application, types in use, laboratory testing, theoretical aspects, use of solvent emulsions.

2. Infra-Red Heating. I. J. Barber. *Steel*, v. 114, no. 3, Jan. 17, '44, pp. 76-77, 110-116.
Process now enlarged to include in addition to baking and drying work preheating and maintaining heat during welding, heating for expansion fits, dehydrating metal products for rust prevention, dehydrating foundry molds and cores.

(Turn to page 12)

Review of Current Metal Literature

21. CLEANING AND FINISHING

(Continued from page 11)

3. **The Nature of Foreign Deposits on Metal Surfaces.** P. D. Liddiard. *Metal Industry*, v. 63, no. 24, Dec. 10, '43, pp. 370-372.
Study of the physico-chemical features which influence the presence of deposits on a metal surface. An attempt has been made to approach the problem of degreasing and residue removal from a molecular angle by studying the forces which exist to retain deposits at a metal surface. These deposits have been classified on this basis and a picture of the mechanism of their removal has been formed.

4. **Electrolytic Polishing of Metals.** S. Wernick. *Metal Industry*, v. 63, no. 24, Dec. 10, '43, pp. 377-380.
Theory, industrial applications and polishing of Al and Ni.

5. **Electrolytic Polishing.** S. Wernick. *Automobile Engineer*, v. 33, no. 444, Dec. '43, pp. 549-550.
A novel method of finishing metal surfaces.

6. **Deburring Metal Parts in Bulk.** Robert Sizelove. *Metal Finishing*, v. 34, no. 1, Jan. '44, pp. 16-17.
5 methods for deburring; each deburring job should be individually engineered to determine type and speed of barrel, medium, ratio of medium to work. These factors determine type of finish obtained.

7. **Technical Developments of 1943.** Nathaniel Hall and G. B. Hogaboom, Jr. *Metal Finishing*, v. 42, no. 1, Jan. '44, pp. 1-9.
Developments in anodizing and corrosion prevention, polishing, cleaning, pickling, coatings, coloring, electroforming, testing and control with a bibliography of 251 items.

8. **Suggestions for Selection of Buffing and Polishing Wheels.** Gerald A. Lux. *Metal Finishing*, v. 34, no. 1, Jan. '44, pp. 12-13, 41.
Definition, and limitations of polishing and buffing; importance of wheel dimensions and shape; Chart: Comparison of wheel speeds.

9. **Decorating Sheet Metal by Lithography.** Stanley T. Dingman. *Metal Finishing*, v. 34, no. 1, Jan. '44, pp. 53-55.
Review of the history and accomplishments of the art of printing of metals.

10. **Ford Tumbles Aircraft Engine Parts.** *American Machinist*, v. 87, no. 26, Dec. 23, '43, pp. 90-92.
Used to conserve labor and increase quality. The work compartment is filled 2/3 full with stone, pumice and water. Barrel speed is 500 r.p.m.

11. **Coil and Armature Drying with Improved Handling and Baking Methods.** *Industrial Heating*, v. 11, no. 1, Jan. '44, pp. 92, 94, 97, 98, 100.
3 Despatch coil-and-armature baking ovens mounted together as a battery face a varnish-tank booth which is fully enclosed. Between varnish booth and ovens there is an open area 18 ft. across.

12. **Simple Method for Etching Metals.** *Iron Age*, v. 153, no. 2, Jan. 13, '43, p. 57.
Cheap and simple method of etching. Method is rapid and simple to operate and gives good results on hard or stainless alloys. Process is electrolytic and makes use of a standard waxed paper stencil on which is typed or printed the required words or designs.

13. **Deburring Aluminum and Light Steel Parts.** G. O. Rowland. *Iron Age*, v. 153, no. 4, Jan. 27, '44, p. 65.
Removing burrs from slots, etc. Relation between fatigue and surface finish.

14. **How Much Pressure for Metal Cleaning Machines.** H. M. Sadwith. *Steel*, v. 114, no. 5, Jan. 31, '44, pp. 94, 115.
To determine the most efficient pressure and orifice size, the following factors are considered: Soil to be removed; shape of part; temperature used; detergent used; hardness of local water supply; and distance from spray to work.

15. **Removing Oil and Grease from Metal Parts.** *Canadian Mining & Metallurgical Bulletin*, no. 381, Jan. '44, pp. 45-48.
The four methods commonly used to remove oil and grease from metal parts are: Use of low flash-point solvents such as gasoline and naptha; use of alkaline compounds which exert a saponifying or emulsifying action on the grease or oil; baking in metal ovens or enclosures; use of liquids which exert a solvent action similar to gasoline, but which are less flammable.

22. WELDING, BRAZING AND FLAME CUTTING

1. **Tool Reclamation.** *Aircraft Production*, v. 5, no. 62, Dec. '43, p. 598.
A new process for tipping tools.

2. **Heavy-Gauge Spot Welding.** F. C. Dowding. *Aircraft Production*, v. 5, no. 62, Dec. '43, pp. 563-565.
On light alloy aircraft. Difficulties, technique, electrode details, cleaning.

3. **Refrigerated Welding Tips Save Time and Money.** *Aviation*, v. 43, no. 1, Jan. '44, pp. 189.
Spot welding speeded up as much as 300 per cent by use of refrigerated electrodes.

4. **Spotwelding Expedites Lockheed "Constellations".** Ellis F. Gardner. *Aviation*, v. 43, no. 1, Jan. '44, pp. 161-165, 363-364.
Research program reveals both design and production advantages via technique heretofore limited almost entirely to non-structural members.

5. **Warehouse Turns Fabricator.** J. G. Magrath. *Welding Engineer*, v. 29, no. 1, Jan. '44, pp. 50-54.
Flame-cutting and welding over 6,000 tons of steel plate annually. Avery and Saul design and produce flame-cut and welded machine parts.

6. **Magnesium Spot Welding.** W. S. Loose. *Welding Engineer*, v. 29, no. 1, Jan. '44, pp. 40-44.
Weldable alloys, cleaning, equipment, pressures, electrodes, properties of welds, corrosion resistance.

7. **A Year of Triumph.** T. B. Jefferson. *Welding Engineer*, v. 29, no. 1, Jan. '44, pp. 35-37.
Ship repair, prefabricated shipbuilding, arc welding, electrode production, gas, chemical, resistance welding.

8. **Importance of Producing Welds of Specified Size.** Clayton B. Herrick. *Industry and Welding*, v. 16, no. 12, Dec. '43, pp. 33-35.
Determination of strength of weld and specifications to be set up prior to welding.

9. **Trapped Slag Control.** Robert Burnett. *Industry and Welding*, v. 16, no. 12, Dec. '43, pp. 27-28.
"Trapped Slag" a defect in weld metal similar to other defects. It will not fuse and it stops penetration, crack undercutting and porosity; it reduces physical properties such as tensile strength, ductility and elongation.

10. **Welding Large Semi-Circular Plates.** George Pettit. *Industry and Welding*, v. 16, no. 12, Dec. '43, pp. 29-32.
The fabrication of welded steel turntables.

11. **Special Welding Positioners Speed Barge Construction.** *Steel*, v. 114, no. 3, Jan. 17, '44, pp. 82, 119.
Portable, well-built fixture used for positioning end sections for maximum welding efficiency.

12. **High Production Flame Cutting.** Harold Lawrence. *Steel*, v. 114, no. 4, Jan. 4, '44, pp. 58-60, 90.
Speeds fabrication. Improved procedures on one job raise man-day output from 72 to 112 pieces. Detailed technique at Lukens subsidiary plant.

13. **Quality Control in Production Welding.** Walter J. Brooking. *Steel*, v. 114, no. 4, Jan. 4, '44, pp. 68-70, 72, 75.
Visual examination and quality control. Specifications, weld metal vs. parent metal, the finished weld, checking.

14. **Improved Technique Employed in Fabricating Large Steel Rings.** *Steel*, v. 114, no. 4, Jan. 24, '44, pp. 56-57.
First step in fabricating is to heat the steel to about 1200° F. in heating furnace, then it is formed into a ring in a ring forming press. After cooling, the ring is moved onto a welding table where the ring joint is flash welded. It then goes back into the furnace. After reheating, the ring is pulled from the furnace with a tractor and taken to a sizing ring which stretches the piece to the proper diameter.

15. **How to Use Resistance Welding.** R. T. Gillette and J. F. Young. *American Machinist*, v. 87, no. 26, Dec. 23, '43, pp. 97-98.
Pulsation welding, percussion welding (a form of flash butt welding) and stored energy welding.

16. **Spot Welding in the Production of the De Havilland "Mosquito".** R. W. Ayers. *Welding*, v. 11, no. 12, Nov. '43, pp. 487-493.
Spot welding light alloys, testing the welding machine, pickling.

17. **Welding in Shipyards.** W. G. John. *Welding*, v. 11, no. 12, Nov. '43, pp. 503-505.
Thermit process, fatigue strength of welded joints, design and application.

18. **Choice and Preparation of Welding Edges for Metal Arc Welding.** E. Fuchs. *Welding*, v. 11, no. 12, Nov. '43, pp. 494-498, 505.
Vee butt joint with and without backing strip, Double-Vee butt joint, U-butt joint, single bevel joint.

19. **Some Practical Considerations in the Design of Welded Structures.** R. G. Braithwaite. *Welding*, v. 11, no. 12, Nov. '43, pp. 520-527.
Advantages of various types of welds in regard to cost and physical limitations.

20. **The Weldability of Cast Iron.** T. J. Palmer. *Metallurgia*, v. 29, no. 169, Nov. '43, pp. 3-6, 25.
The different types of cast iron are outlined, and certain structural differences are illustrated. A welding process where the heat input per unit volume is relatively low is most suitable for the joining of cast iron, and gas welding methods form the subject of this discussion. Particular attention is given to fusion welding, which remains the most widely used process.

21. **Cycle-Welding Breaks the Barrier to Assembly with Cement Bonds.** *American Machinist*, v. 88, no. 1, Jan. 6, '44, pp. 106-114.
Savings realized on structural products not designed for the process indicate enormous possibilities for new constructions in the postwar period.

22. **How to Utilize Brazing in Design.** Colin Carmichael. *Machine Design*, v. 16, no. 1, Jan. '44, pp. 120-123, 198-200.
Proper heating method to secure strong and economical brazed joints; designing parts for furnace brazing, sources of high frequency current, fast heating time, fabricating technique.

23. **Soldering Techniques.** *Metal Industry*, v. 63, no. 25, Dec. 17, '43, pp. 392-393.
Design, preparation of work, fluxes, wiping solders, and hand-iron soldering.

24. **Fusion Welding of Wrought Aluminium Alloys—IV.** *Metal Industry*, v. 63, no. 24, Dec. 10, '43, pp. 375-376.
Carbon arc, Heliarc, atomic hydrogen welding, "Weibel" process, "Technotherm-Rakos" process, weld inspection.

25. **Fusion Welding of Wrought Aluminium Alloys—III.** *Metal Industry*, v. 63, no. 23, Dec. 3, '43, pp. 358-360.
Chemical and heat treatment, arc welding—preparation, electrodes, current conditions, procedure. Horizontal and vertical welding.

26. **Fusion Welding of Wrought Aluminium Alloys—II.** *Metal Industry*, v. 63, no. 22, Nov. 26, '43, pp. 343-346.
Welding rods, preparation for welding, technique used, vertical welding.

27. **Fusion Welding of Wrought Aluminium Alloys—I.** *Metal Industry*, v. 63, no. 21, Nov. 19, '43, pp. 326-328.
A general guide to the principles of fusion welding of wrought aluminium alloys and summary of the chief details of the procedure found by experience to be suitable for the gas and arc processes. As long as the underlying factors are understood it is possible and economic to make sound welds consistently and on a mass-production basis.

28. **The Influence of Welding Defects on the Resistance to Fatigue of Welded Steel Joints.** J. Dearden. *Transactions, Institute of Welding*, v. 6, nos. 3-4, July-Oct. '43, pp. 120-122.
A critical review of the technical literature.

29. **Third Interim Report on the Investigation of the Welding of Ships' Structures.** James Turnbull. *Transactions, Institute of Welding*, v. 6, nos. 3-4, July-Oct. '43, pp. 105-119.
Machine tests, description of tests and results.

Review of Current Metal Literature—(Continued)

22. WELDING AND CUTTING

(Continued from page 12)

30. **Welding of Aluminium for the Chemical Industry.** F. H. Keating and G. Haim. *Transactions, Institute of Welding,* v. 6, nos. 3-4, July-Oct. '43, pp. 135-143.
Corrosion, metallic arc welding of Al, manufacturing suitable electrodes, manufacture on a commercial scale.

31. **Welding Research and Development in the U.S.A.** H. W. G. Hignett. *Transactions, Institute of Welding,* v. 6, nos. 3-4, July-Oct., '43, pp. 99-104.
Comparison of British and American welding research.

32. **Experiments with the Fabrication of an Aero Engine Exhaust Manifold in Austenitic Chromium-Nickel Steel.** K. J. B. Wolfe. *Transactions, Institute of Welding,* v. 6, nos. 3-4, July-Oct., '43, pp. 123-134.
Suitable materials and welding technique for the mass production of a radial-type aero engine exhaust manifold. Austenitic sheet materials recommended as "immune from weld decay" suffer intercrystalline corrosion under the Hatfield test after welding. Molybdenum bearing 18-8 type of sheet material and an 18-8 electrode has been produced containing both Mo and Cb as stabilizing agents. Welds produced by the above materials do not suffer intercrystalline corrosion under the Hatfield test. The physical condition of the welds was determined by means of the Olsen ductility test.

33. **Cycle-Welding Process for Bonding Structural Materials.** *Product Engineering,* v. 15, no. 1, Jan. '43, pp. 1-5.
Joining process for bonding of metallic and nonmetallic materials to each other in any combination.

34. **Welding Organization and Training.** C. W. Johnston. *Iron Age,* v. 153, no. 2, Jan. 13, '43, pp. 58-61.
Setting up an efficient welding organization and training welders.

35. **Control of Welding Hazards in Shipbuilding.** *Industry & Welding,* v. 17, no. 1, Jan. '44, pp. 40, 42.
Flash burns, welding fumes and lead poisoning in shipyards.

36. **Correcting Causes of Cracks in Welded Aircraft Engine Mounts.** Wm. H. Irwin. *Industry & Welding,* v. 17, no. 1, Jan. '44, pp. 32-33, 59.
Analysis of causes of cracks and technique for their correction.

37. **Welding to Speed Production of Military Trailers.** N. A. Rowe. *Industry & Welding,* v. 17, no. 1, Jan. '44, pp. 29-31.
Use of welding in production of 3 different types of trailers at Fruehauf plant.

38. **Carbon Arc Welding of Naval Brass.** K. L. Walker. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 25-29.
Carbon arc welding low pressure vessels of Naval brass.

39. **War Emergency Codes for Unfired Pressure Vessels.** E. R. Fish. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 30-33.
Emergency codes for unfired pressure vessels as established by the American Welding Society, A.S.M.E. Boiler Code Committee, American Petroleum Institute, American Iron & Steel Institute, the American Standards Association and government agencies. Special materials, flanges, safety factors.

40. **Rolling Mill Maintenance and Production Welding Problems.** Theodore W. Morgan. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 34-43.
Problems of maintenance and production in the welding department of Butler, Pa., Division of the American Rolling Mill Co. Apparatus maintenance and repair.

41. **Reclamation of Perishable Tools by Low Temperature Brazing.** W. A. Johnson. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 43-45.
Increased research, study and application of the oxyacetylene torch with low-temperature alloy rods can be used for repairing and reworking damaged or broken tools.

42. **The Job Shop—Yesterday and Tomorrow.** Fred W. Shackleton. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 46-47.
History, war work and probable future of job welding shops.

43. **Quality Control in Aircraft Spotwelding.** Nathan C. Clark. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 48-59.
Suggested steps to secure highest quality spotweld production in the aircraft industry by standardization of equipment, application of statistical control and monitoring of the spotwelding machines.

44. **Contact Resistance Measurements as Control for Preweld Cleaning of Aluminum Alloys.** G. W. Scott, Jr., and E. B. Charles. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 1s-7s.
When the contact resistance values from the final cleaning tank exceed a level chosen by experience it is an indication (1) that the solution has deteriorated from continued use, (2) that prescribed cleaning procedure has not been carefully followed, (3) that the cleaned material has been exposed to factory atmosphere too long, (4) that the solution has been accidentally contaminated, (5) that the solution concentration or pH has deviated from the optimum value or (6) that the material cleaned is below 0.040 in. in thickness. Apparatus and technique.

45. **Weldability Tests of Silicon-Manganese Steels.** Clarence E. Jackson, George G. Luther, and Kenneth E. Fritz. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 33s-42s.
Technique, methods and results of tests. 17 ref.

46. **Discussion of Means for Evaluating Weldability of Alloy Steels.** S. A. Herres. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 43s-49s.
Causes of unweldability of steel and how their existence can be detected. 9 ref.

47. **Effect of High Welding Current Intensity on Shrinkage.** *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 60s-62s.
Investigations on arc butt welds to determine, for plates of various thickness, the amount of shrinkage caused by welding speed, strength of current and size and coating of electrode.

48. **Electric Resistance Welded Steel Tubing.** R. D. Malm. *Steel Processing,* v. 29, no. 12, Dec. '43, pp. 635-636.
Quality control factors: Analysis, surface finish, thickness tolerance, hardness, type, grain size, chamber, single slit or multiple strand.

49. **Weldability of 27% Chrome Steel Tubing.** R. A. Mueller, I. H. Carlson and E. R. Seabloom. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 12s-22s.
Materials, effect of temperature, electrode tests, preheating, heat treatment, metallographic examination, tensile tests. 24 ref.

50. **Ductile Weld Metal.** C. T. Gayley and J. G. Willis. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 8s-11s.
Significant increase in the ductility of arc-deposited mild steel weld metal was made by the use of shielded arc electrodes. Minor advances have since been made through improvements in the electrode coatings and the development of welding technique. These improvements make the deposition of mild steel weld metal having greater ductility than cast steel, or worked and annealed mild steel, an everyday occurrence. Consideration of the results obtained with the rapid transverse weave technique described herein makes it seem fair to conclude that in order to deposit mild steel weld metal of the highest ductility a proper balance between heat dispersion, energy of the arc, size of the electrode and rate of advance and traverse must be obtained.

51. **Better Welds Through Regulated Welding Current.** B. Copper. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 5-10.
Maintenance of welding current at its proper value in spite of variations in influential factors by use of current regulator as an auxiliary control.

52. **Electronic Control of Gas-Cutting Machines.** R. D. McComb. *Welding Journal,* v. 23, no. 1, Jan. '44, pp. 11-15.
Operation of a gas cutting machine with an electronic control. Diagrams of the control.

53. **Welding Non-Ferrous Metals.** Warren R. Coulter. *Canadian Metals & Metallurgical Industries,* v. 7, no. 1, Jan. '44, pp. 16-20.
Condensed review of practical techniques. Welding Cu, Cu_3Si alloys; 18-8 and other stainless steels, Monel, Ni, Inconel and Al.

54. **The Production of Composite Tools.** *Machinery,* v. 63, no. 1625, Dec. 2, '43, pp. 631-634.
Process for making high speed steel tipped and butt welded tools.

55. **Fabricating Marine Parts.** J. R. Mitchell and A. A. Young. *Steel,* v. 114, no. 5, Jan. 31, '44, pp. 70-71.
Arc welding aids production record in manufacturing gear drives, templates, and other vital marine parts.

56. **Weld-Forging.** *Steel Processing,* v. 30, no. 1, Jan., '44, pp. 21-24.
Examples, results, gear-wheel assembly, bracket construction, choice of welding process, and smelting effects.

57. **Welding in the Eighth Army.** J. Whitworth. *Welding,* v. 12, no. 1, Dec. '43, pp. 3-8.
Contribution made by welders to the successful North African campaigns. Difficulties which had to be overcome to keep the mechanised forces of the Eighth moving onward.

58. **Application of Weld-Deposited Cutting Edges on Tools.** D. D. Howat. *Welding,* v. 12, no. 1, Dec. '43, pp. 35-39.
Advantages are: Saving in high-speed steel, greatly increased resistance to shock, reduction in wear and tear of machines, and good heat conductivity. Type of welding rod used, preparation, technique, treatment after welding, performance, and economics. Direct deposition of weld metal for repair. Arc welding and flash butt welding.

59. **Building-Up and Hard Surfacing by Welding.** William Andrews. *Welding,* v. 12, no. 1, Dec. '43, pp. 9-15.
The process of using fusion welding for renewing worn or corroded parts. It can also form part of the original design for many structures. 10 ref.

60. **Resistance Welding—a Film.** *Welding,* v. 12, no. 1, Dec. '43, pp. 16-21.
Synopsis of the commentary to the new sound film on resistance welding.

61. **Design for Welding.** F. W. Sykes. *Welding,* v. 12, no. 1, Dec. '43, pp. 22-27.

23. INDUSTRIAL USES AND APPLICATIONS

1. **Metals in Post-War America.** Ernest E. Thum. *Metal Progress,* v. 45, no. 1, Jan. '44, pp. 73-77, 126.
Future of Fe, Stainless Steel, Cu, Ni, Al, Be, Pb, Sn and Zn.

2. **Steel Aircraft Tubing of NE8630 Steel.** A. J. Williamson. *Metal Progress,* v. 45, no. 1, Jan. '44, pp. 115-118.
NE8630 tubing compared with 4130. Properties and test results given.

3. **Production, Utility and Acceptance of the NE Steels.** *Metal Progress,* v. 45, no. 1, Jan. '44, pp. 109-114.
Series of brief articles by E. E. Thum, Charles M. Parker, John H. Frye, J. B. Johnson. NE Steels, their formulation and acceptance by the Armed Services.

4. **Future Trends in High Alloy Steels.** S. M. Norwood. *Metal Progress,* v. 45, no. 1, Jan. '44, pp. 86-87.
Compositions, corrosion resistant alloys, uses.

5. **Phosphorescent Templates.** *Business Week,* no. 751, Jan. 22, '44, p. 68.
New phosphorescent lacquers and photographic emulsions simplify production of templates of highest accuracy.

6. **S.A.E. Forecast.** *Business Week,* no. 751, Jan. 22, '44, pp. 64, 66.
Automotive engineers fail to agree on extent of postwar use of light metals, but comparative costs are likely to govern. Account of recent meeting of Society of Automotive Engineers.

7. **Piston Metallurgy.** *Aircraft Production,* v. 5, no. 62, Dec. '43, pp. 572-574.
Metallurgical data obtained by investigation of light alloy pistons from German aircraft; types of alloys in use, quality, methods of manufacture employed, and mechanical properties.

8. **Hollow Steel Airscrew-Blade Production.** H. W. Perry. *Aircraft Engineering,* v. 15, no. 177, Nov. '43, pp. 331-333.
High strength alloy steel for airscrew blades. Production methods.

9. **Designing Bearings for Fluid Film Lubrication.** Arthur H. Korn. *Machine Design,* v. 16, no. 1, Jan. '44, pp. 134-136.
Available information and test results from two authoritative sources in the form of a practical chart on load-carrying characteristics of sleeve bearings.

10. **Aluminum—The Precious Metal.** R. H. Ramsey. *Crown,* v. 33, no. 1, Jan. '44, pp. 9-11, 28.
General picture of the possibilities of Al in post-war world.

11. **The Production of Slab Tools for Form Twining.** *Machinery (London),* v. 63, no. 1621, Nov. 4, '43, pp. 508-510.
Operations used in the production of slab tools for form twining used at Precision Grinding, Ltd., with description of some of the inspection methods. Diagrams.

12. **Grasshopper Wheels.** Byron H. Shinn. *Die Casting,* v. 2, no. 1, Jan. '44, pp. 25-27.
Meeting a 5-ton radial load test and over 1½ ton side load test die cast wheels have had a satisfactory service record since 1936.

13. **Safe Cans.** *Die Casting,* v. 2, no. 1, Jan. '44, pp. 25-26.
Substitution of zinc alloy die castings for brass sand castings results in saving of 25% in manufacture of cans for handling volatile liquids.

14. **Tool Steel Identification System.** *Iron Age,* v. 153, no. 2, Jan. 13, '44, pp. 67, 139.
A system for classifying and identifying domestic high speed steel cutting tools.

15. **Superchargers for Aircraft Engines.** R. G. Standerwick and W. J. King. *Transactions, American Society of Mechanical Engineers,* v. 66, no. 1, Jan. '44, pp. 61-73.
Comprehensive treatment covering the development of turbo-superchargers which make possible the outstanding performance at high altitudes of U.S. military aircraft. 29 ref.

16. **Metals of the Future.** C. H. Mathewson. *Mining and Metallurgy,* v. 25, no. 445, Jan. '44, pp. 5-11.
Possible future utilization of the unfamiliar metals.

17. **Woven Wire Conveyor Belts for Industrial Applications.**

1. **Metals and Alloys Used in Construction.** S. Craig Alexander. *Industrial Heating,* v. 11, no. 1, Jan. '44, pp. 38, 40, 42, 44, 50.
Needs have been met by improving quality, developing special alloys, improving heat treatment methods. Corrosion, mechanical properties, fatigue, corrosion fatigue, high and low temperature effects are studied.

18. **Solves Fabricating Problems in Compressor Manufacture.** Stephen J. Benn. *Industry & Welding,* v. 17, no. 1, Jan. '44, pp. 50, 52.
Compressors made cheaper and faster by electric arc welding fabrication.

19. **Operating Temperatures and Stresses of Aluminum Aircraft-Engine Parts.** E. J. Willis and R. G. Anderson. *Transactions, S.A.E. Journal,* v. 52, no. 1, Jan. '44, pp. 28-36.
To establish the operating temperatures of aluminum cylinder heads and pistons, the authors have developed a method that takes advantage of the fact that the Brinell hardness of the cylinder head and piston decreases with the number of hours of service and the temperature at which the part operates.

20. **Hints as to Automotive Future Gleaned From SAE Meeting.** Guy Hubbard. *Steel,* v. 114, no. 5, Jan. 31, '44, pp. 68-69.
Lessons learned in school of war to have profound effect on design and production of machines which will travel on land, in the water and through the air, even though transition from the old to the new will take much longer than the public is being led to believe.

21. **A Swedish Aero Engine of 2500 H.P.** *Engineers' Digest,* v. 1, no. 2, Jan. '44, pp. 83-84.
Description of the 2500-h.p. 42-cylinder radial unit engine designed by Mannerstedt.

22. **Light Metals and the Motorcycle.** Joe Craig. *Light Metals,* v. 7, no. 72, Jan. '44, pp. 20-30.
How lightness was "added" to a successful racing motorcycle by the judicious use of aluminium and magnesium alloys.

23. **Aluminium in Automobiles.** Laurence Pomeroy. *Light Metals,* v. 7, no. 72, Jan. '44, pp. 3-10.
A consideration of factors assuring the achievement of the practical light-metal car.

24. **Wrought Aluminium Alloys in Post-War Building.** E. G. West. *Light Metals,* v. 7, no. 72, Jan. '44, pp. 11-19.
Before the war the aluminium alloy industry was quickly expanding its markets in all industrial spheres on purely competitive and economic lines. This movement was checked by the demands of war which dictated that every ounce of aluminium should go to the manufacture of such high priority armaments as aeroplanes and aeroplane parts. The present one-way development of the alloys which stopped the natural evolutionary applications and demanded this abnormal production will cease to provide more than a comparatively small outlet when hostilities cease.

25. **Gettering and Getters.** *Light Metals,* v. 7, no. 72, Jan. '44, pp. 34-52.
A comprehensive account of the theory and practice of the use of aluminium and magnesium and special alloys of these metals in the cleaning-up of high vacuo.

26. **Rivet Wire and Rivets of Al-Cu-Mg Alloy.** Sven Tobert. *Engineers' Digest,* v. 1, no. 2, Jan. '44, pp. 96-97.
Rivets used in aircraft construction are usually of Al-Cu-Mg alloy with approximately 4% Cu, 0.6% Mg, 0.5% Mn, 0.3% Si, and 0.3-0.4% Fe. Commonly, rivets are driven cold, a few hours subsequent to a solution heat treatment at about 500° C. followed by rapid cooling. As the rivets are subject to rapid age-hardening at ordinary room temperatures, they must be driven within a short time after treatment in order to avoid the formation of cracks. Keeping the treated rivets on ice makes it possible to retain them in soft state for a somewhat longer time; but, in the author's opinion, this method cannot be considered practical; nor does the comparatively small gain in time justify its use. In actual shop practice, therefore, solution heat treatment is carried out in batches commensurate with the expected rate of demand.

27. **Tool Steel Identification System.** *Iron Age,* v. 153, no. 2, Jan. 13, '43, pp. 67, 139.
Classifying and identifying domestic high speed steel cutting tools as agreed on by the three major automobile companies in Detroit.

(Turn to page 15)

Guide to Metallurgical Books

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by Gordon T. Williams, Metallurgist, Deere & Co., Moline, Ill.

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International Unity Needed to Build Post-War World

—Deutsch

Reported by Eli A. Haddad
Chemist, Wyman-Gordon Co.
(Photo on page 16)

Worcester Chapter—The lesson of international unity, how to pull together in the greatest job of teamwork in history, is one of the most important wartime lessons for the American people, Dr. Karl W. Deutsch of Massachusetts Institute of Technology, told the meeting on Jan. 12.

Speaking on "Building the Post-war World Today" at the chapter's annual Sustaining Members Night dinner meeting, he said:

"We're learning the habit of unity, most important in overcoming the dangers of hate and fear. The most crucial test is coming in the next few months, in the invasion of Western Europe. In this, it must be remembered, it's not important who scores the goal. The interference for the ballcarrier is equally vital.

"Some carry the main load at one time, others at another. Britain carried the whole load in 1940. In 1941, Russia carried the ball and has done so from then to now. Very soon it will be men from our country who will be on the spot marked 'X'."

Forecasts Nazi Defeat

Dr. Deutsch, M.I.T. instructor in history and international relations and a native of Prague, Czechoslovakia, forecast that Nazi Germany could be "written off the book" six months after the invasion starts.

Although it is technologically impossible for the Nazis to invent and manufacture new lethal weapons in sufficient quantity to win the war, Dr. Deutsch said, they can still turn out new instruments of war—given enough time—that could be "very disagreeable" to the Allied nations.

"Never has time been so much of the essence as it is in 1944," he declared.

Nelson W. Dempsey, chapter chairman, presided at the meeting, and Lloyd G. Field was technical chairman and introduced the speaker. It was announced that Worcester industries are now represented by 55 sustaining memberships in the chapter.

—V—

To sustain the war efforts and the civilian economy of American industry and American people, approximately one-fourth of the current record-breaking output of steel is allocated for purposes other than the primary production of goods used directly or indirectly for war.

Review of Current Metal Literature—(*Continued*)

24. DESIGN

1. Design It Correctly. Marc. Stern. *Die Casting*, v. 2, no. 1, Jan. '44, pp. 13-15, 44.
Specific information on good design practice in various parts of a die casting. Sound principles backed by experience (to be continued).

2. Threading. R. R. Weddell. *Tool Engineer*, v. 13, no. 1, Jan. '44, p. 71.
Important factors for producing smooth, accurate threads. Design and care of tools, gaging, tool and machine attachments, and machine conditions.

3. Calculation of Stiffened Shells in Metal Airplane Design. E. Schapitz. *Engineers' Digest*, v. 1, no. 2, Jan. '44, pp. 91-95.
1. The features of shell structures. 2. The special strength requirements in airplane design. 3. The problems of stress analysis in metal aircraft design. 4. Stability conditions. 5. Stiffened plates and shells subsequent to buckling of the skin. 6. Elementary calculation of stiffened shells. 7. Diffusion problems.

25. MISCELLANEOUS

1. Metallurgical Department of Small Arms, Ltd. W. S. Craig. *Canadian Metals & Metallurgical Industries*, v. 6, no. 12, Dec. '43, pp. 20-23.
Modern organization and equipment aid production.

2. Production Control—a Method of Approach. William F. Walker. *Machinery (London)*, v. 63, no. 1622, Nov. 11, '43, pp. 548-552.
Detailed outline of a suggested works production meeting to achieve more economical production methods.

3. Training Spurs Production at Rock Island Arsenal. Waldo C. Wright. *Modern Machine Shop*, v. 16, no. 8, Jan. '44, pp. 140-156.
Fitting inexperienced men to war jobs in a government plant by apprenticeships, in training service and incidental assignments.

4. Building "Liberators". C. W. Greaves. *Modern Machine Shop*, v. 16, no. 8, Jan. '44, pp. 124-136.
Outline of mass production methods in use at the San Diego plant of Consolidated Vultee Aircraft Corp.

5. Fixture Aids Marine Crankshaft Assembly. *American Machinist*, v. 87, no. 26, Dec. 23, '43, pp. 88-89.
Assembly of 16-ton crankshaft in Liberty ship at Joshua Hendy Iron Works.

6. Enemy Weapons Show Effect of Critical Material Shortages. John Haydock. *American Machinist*, v. 88, no. 1, Jan. 6, '44, pp. 115-116.
The Foreign Materiel Division, at Aberdeen, tears down and carefully inspects captured enemy weapons; the outstanding finding is that poor quality, and often poor design, is certain to accelerate defeat of the Reich.

7. Self-Diffusion in Minerals, Particularly Copper Sulphides. A. M. Gaudin and Kenneth C. Vincent. *Mining Technology*, v. 8, no. 1, Jan. '44, Tech. Pub. 1663, 6 pages.
Experimental technique and results. There was no acquisition of radioactivity by sphalerite from radioactive Zn in solution, or from chalcocite. There was considerable acquisition of radioactivity when chalcocite was in contact with radioactive Cu in aqueous solution. 10 ref.

8. Special Devices Used in Aircraft Work. *Machinery (London)*, v. 63, no. 1625, Dec. 2, '43, pp. 625-626.
Description of simple devices for holding heavy work pieces and speeding damping processes which have been developed in the North American Aviation plant.

9. Stack to the Ceiling. W. J. Kennedy. *Steel*, v. 114, no. 3, Jan. 17, '44, pp. 94, 122.
One plant enlarged its storage space 400% by use of special stacking machine.

10. Rivet Waste. *Steel*, v. 114, no. 2, Jan. 10, '44, p. 84.
Waste prevented by device that facilities placing rivets in structure.

11. Conditioning of Greaseless Abrasive Compounds at −20° F. H. Seman Payne. *Metal Finishing*, v. 34, no. 1, Jan. '44, pp. 10-11.
By conditioning is meant storing the compounds in a −20° F. atmosphere until they have attained this temperature throughout. This effects a savings of 37%.

12. Lubrication. *Automobile Engineer*, v. 33, no. 444, Dec. '43, pp. 523-527.
Hydrodynamic action, surface finish, oiliness, antiseizure additives, bearing surfaces, lubrication effects, loading, atomic seizure, choice of lubricants, mineral oils.

13. Calculating Beam Deflections. C. L. Brown. *Machine Design*, v. 16, no. 1, Jan. '44, pp. 124-126.
Reliable results obtained with considerable savings of time and effort for beam and shaft deflections.

14. Electrical Installation of the Kaiser Steel Mills at Fontana. George Scheer. *Blast Furnace and Steel Plant*, v. 32, no. 1, Jan. '44, pp. 96-100.
Description of the electrical installations at the plant and how they are used.

15. Ordering Raw Materials for the Stamping Shop. C. W. Hinman. *Steel Processing*, v. 29, no. 12, Dec. '43, pp. 632-634.
Time saving system.

16. Postwar Aviation—Part 2. *Aeronautical Engineering Review*, v. 3, no. 1, Jan. '44, pp. 21-32, 37-41.
A selective bibliography on peacetime plans and problems.

17. Scientific Marking of Aircraft Parts Aids Quality Control. C. A. Banze. *Aero Digest*, v. 44, no. 2, Jan. 15, '44, pp. 118-120, 217.
Stamping of all parts with individual inspectors' and manufacturers' marks places responsibility for faulty work.

18. Carbon Dioxide Fire Protection in the Steel Industry. C. A. Getz. *Iron & Steel Engineer*, v. 21, no. 1, Jan. '44, pp. 75-78.
The application of carbon dioxide for fire protection. Outline of a number of steel plant installations.

19. Remember the Past and Look to the Future. F. C. Lea. *Engineers' Digest*, v. 1, no. 2, Jan. '44, pp. 81-82.
1. Study of mechanics of fluids, leading to theory of similarity and the use of models. 2. Development in engineering materials. 3. Non-destructive tests of materials. 4. Production of alloys electrically. 5. Position of mechanical engineering as a scientific profession.

20. Low Temperature Grease Research. *Lubrication*, v. 30, no. 1, Jan. '44, pp. 1-8.
The lubricants which have been developed to enable military aircraft bearings to meet low temperature requirements so dependably, still will be greatly in demand after wartime restrictions are lifted. The pre-war problem was sluggish bearings; if temperatures much below zero, solution will be the lubricants which the petroleum industry has developed for aviation to insure free rolling motion at temperatures approaching −100° F.

26. STATISTICS

1. What Happened in 1943. *Iron Age*, v. 153, no. 1, Jan. 6, '44, pp. 64-126.
A general review followed by specific articles on nonferrous metals, renegotiation, labor, machine tools, metallurgy, welding, and export.

2. Industry at War Prepares for Peace. *Steel*, v. 114, no. 1, Jan. 3, '44, pp. 195-233.
Steel—the material; steel's production facilities; statistical position of the steel industry; steel's distribution facilities; steel's markets—automobiles, oil, gas, water, shipbuilding, aircraft, construction, machine tools, machinery and equipment, appliances, exports, agriculture, containers, railroads.

3. Concentration of Iron Ores in the United States. T. B. Counselman. *Mining Technology*, v. 8, no. 1, Jan. '44, Tech. Pub. 1629, 17 pages.
Rates of production, Lake Superior reserves; methods of concentration; results from concentration.

4. Iron Ore Review—1943. M. D. Harbaugh. *Blast Furnace and Steel Plant*, v. 32, no. 1, Jan. '44, pp. 59-64, 121-123.
A review of the iron ore industry for 1943 in the U.S. and Canada, with output by districts. Tables.

5. The Open Hearth in 1943. Frank G. Norris. *Blast Furnace and Steel Plant*, v. 32, no. 1, Jan. '44, pp. 73-77.
Brief survey of the open hearth industry for 1943, discussing production, advances and problems. Brief bibliography.

6. 1943 Electrical Progress in the Steel Industry. F. Mohler. *Blast Furnace and Steel Plant*, v. 32, no. 1, Jan. '44, pp. 78-82.
Highlights in the 1943 electrical developments in the steel and aluminum industries.

7. 1943—A Year of Remarkable Performance in Production of Open Hearth Steel. Ralph Vaill. *Blast Furnace and Steel Plant*, v. 32, no. 1, Jan. '44, pp. 68-69.
Advances made in 1943 in the production of open hearth steel. Handling ladle alloys, bath temperature measuring instruments, suspended silica brick main roof, rammed bottoms.

8. Symposium on Technical Progress in the Steel Industry. *Steel*, v. 114, no. 1, Jan. 3, '44, pp. 270-272, 274, 276, 278, 284, 286-288, 292, 294-295, 297, 298, 300-302, 305-306, 310, 313, 314, 380-398.
Brief reviews of metallurgy, materials handling, joining, welding, steel making, heat treating, finishing, casting, machining, forging.

9. Developments in the Iron and Steel Industry During 1943. W. H. Burr. *Iron & Steel Engineer*, v. 21, no. 1, Jan. '44, pp. 79-92.
A broad perspective of 1943 in the steel industry brings out two important but anomalous points—the steel industry has produced enough steel, and the program to boost annual steel capacity by 10,000,000 tons has fallen far behind schedule.

10. Annual Engineering Review. *Metals and Alloys*, v. 19, no. 1, Jan. '44, pp. 67-114.
Covers production of metals, foundry practice, metal working and treating, materials and engineering design, quality inspection and control.

27. BIBLIOGRAPHY

1. Review of Iron and Steel Literature. E. H. McClelland. *Blast Furnace and Steel Plant*, v. 32, no. 1, Jan. '44, pp. 109-112, 120.
List of books and pamphlets on iron and steel published in 1943. No journals included.

2. Ammunition: Its History, Development and Use 1600-1943—.22 BB Cap to 20 Mm. Shell. Melvin M. Johnson, Jr. and Charles T. Haven. 361 pp. Wm. Morrow and Co., 386 4th Ave., New York; $5.00.

3. Atlas of Isothermal Transformation Diagrams. 104 pp., illus. U. S. Steel Corp., 436 Seventh Ave., Pittsburgh, Pa.; free.

4. Laboratory Manual of Spot Tests. Fritz Feigl. 276 pp., illus. Academic Press; $3.90.

5. Maintenance Arc Welding. A. F. Davis and Ed C. Powers. 234 pp., illus. James F. Lincoln Arc Welding Foundation, 12818 Coit Rd., Cleveland, Ohio; 50c.

6. Steel in Action: Science for War and Peace Series. Charles M. Parker. 221 pp., illus. Jaques Cattell, N. Queen St. and McGovern Ave., Lancaster, Pa.; $2.50.

7. Review of Iron and Steel Literature. E. H. McClelland. *Steel Processing*, v. 30, no. 1, Jan. '44, pp. 36-40.
The 27th annual review of iron and steel literature, published in 1943.

See Materials Index on Page 16
A Cross-Index by Metal or Alloy of All the Articles Annotated in the Literature Survey.

Three Factors Considered in Good Design

—*Wilson*

Reported by John E. Comfort
Pacific Metal Co.

Oregon Chapter—Two films, "Sight Seeing at Home" by General Electric Co. and "The Metal Without an Equal" by Ampco Metal, Inc., opened the regular meeting on Jan. 7. The first film showed some interesting developments of television, and the second was a step-by-step portrayal of the manufacture and casting of aluminum bronze.

"Design for Tomorrow" was the timely subject of the evening's talk by John E. Wilson of the Climax Molybdenum Co. of Michigan.

It was pointed out that the full potentialities of the steels that are now available are not used in many cases due to "over design" resulting from a lack of understanding of complicated applied stresses, and the fear of non-uniform materials.

Evaluate Stresses Accurately

"Good design", said Mr. Wilson, "is dependent upon our ability to *(a)* evaluate accurately the stresses that may be imposed, *(b)* select satisfactory materials, *(c)* assure reliability of product through inspection, and *(d)* protect the surface of the part while in service." If attention is given to these factors, a noticeable improvement may be expected.

However, those parts or structures subject to fatigue deserve special consideration because of present limitations in measuring residual stresses, and stresses at a given spot. The improvement that may be obtained in the life of a part subject to fatigue as a result of imposing compressive stresses at the surface through such treatments as cold working, nitriding, carburizing, and surface hardening was stressed.

Mr. Wilson cautioned at the same time that some method such as that proposed by Mr. Sachs or Mr. Almen should be used to measure the stresses developed during these treatments, since the high tensile stresses developed below the surface may result in premature failure.

Precautions in Processing

Since all stresses are not beneficial, the designer as well as the manufacturer of tomorrow will not only indicate processes to impose beneficial surface stresses, but they will guard against detrimental stresses being developed in critical parts during such processing operations as grinding, rough machining, forming and punching, straightening, cooling castings and forgings, heat treating.

During the discussion, mention was made that special attention is now being given to the maleffect of stresses developed during the hardening of steels to high levels and the heat treatment of steel parts having critical sections. In this connection the usefulness of martempering and austempering was discussed.

High Yield Steels Used

The fact that the ability to fabricate limits the extent to which the properties of materials can be used, as well as the design that will eventually be adopted, formed the basis of the second part of Mr. Wilson's talk. Such methods of fabricating as welding, brazing, the use of thermoplastic cements, etc., were discussed and the possibility of using steels having yield strengths three times those normally used was indicated.

The use of castings in design having higher yield strengths was discussed in the concluding section of Mr. Wilson's talk. Mention was also made of the factors affecting the ductility of cast steels, and some of the limiting differences that might be encountered in the use of cast and wrought steels.

Worcester Chapter Sustaining Members' Meeting

Left to Right Are Nelson W. Dempsey, Chapter Chairman, Dr. Karl W. Deutsch of M.I.T., Who Spoke on "Building the Post-War World Today", and Lloyd G. Field, Technical Chairman. *(Story on p. 14)*

Materials Index

To the Metal Literature Survey

The following tabulation classifies the articles annotated in the preceding pages according to the metal or alloy concerned. The articles are designated by section and number. The section number appears in bold face type and the number of the article in light face. For instance, under "General Ferrous" 1-1-5-6-7-8-12-13 refers to articles No. 1, 5, 6, 7, 8, 12 and 13 in Section 1 on Production of Metals; 2-9 refers to article No. 1 under Section 2 on Properties of Metals, etc.